

Trouble-shooting instructions : FER-5001
BOSCH system : KE-Jetronic 2.5
Make of vehicle : FERRARI
Basic microcard : MB-505

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

FERRARI Testarossa (US, CH, J) 05.85->
with 5.0 l / 12-cyl. engine
270 kW (368 PS)

- * KE-Jetronic 2.5
- * Lambda closed-loop control
- * Start valves provide additional acceleration enrichment at engine temperatures below 63°C.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

A detailed trouble-shooting description is given in the trouble-shooting chart in the similar detailed instructions.

NOTE : Even if reference is made to similar detailed instructions, the set values, terminal designations and special features in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Always pay attention to the information given in the similar detailed instructions, so as to avoid injuries to people and to prevent damage to engine, trigger boxes and control units or ignition system.

CAUTION!

Heavy duty ignition system with hazardous high and low tension!

Coming into contact with live parts or terminals can be fatal (on both primary and secondary side).

When testing compression, detach pump relay, so as to avoid unwanted injection of the injection valves.

Important information regarding work on the KE-Jetronic.

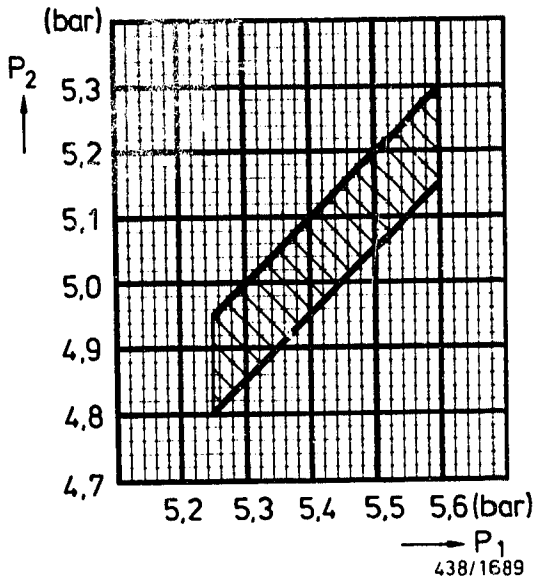
If any fuel connections are detached or parts removed (including on vacuum system), then new gaskets are always to be fitted when re-connecting or re-attaching.

Always maintain utmost cleanliness when working on the KE-Jetronic. The outsides of fuel connections are to be thoroughly cleaned prior to disconnection.

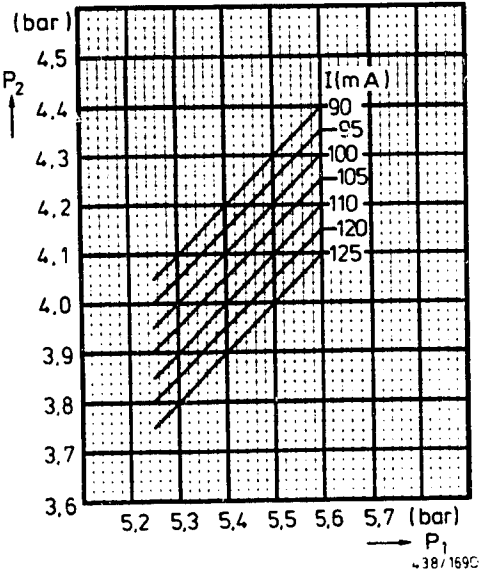
When performing tests with the electric fuel pump running, never deflect (raise) the sensor plate of the air-flow sensor as this causes fuel to be injected via the injection valves. Such procedure can lead to extremely severe engine damage when the engine is subsequently started.

TEST SPECIFICATIONS

No.	Test/Test conditions	Set values	
1	Electric fuel pump – delivery per pump:	min. 1500 cm ³ /min	
2	System pressure:	5,25...5,6 bar	
3	Differential pressure: Take lower-chamber-pressure set value "warm" in accordance with measured system pressure from top diagram. (Actuator current 10 mA) Take lower-chamber-pressure set value "cold" in accordance with measured system pressure and actuator current from lower diagram. Tolerance ± 0.15 bar. Simulation of "cold" condition: Detach connector at engine temperature sensor.		
4	Leak test – entire system: Minimum pressure after 10 min.: Minimum pressure after 20 min.:	2,9 bar 2,8 bar	
5	Injection valves – opening pressure:	3,0...4,1 bar	
6	Delivery – comparative measurement: (Actuator current 10 mA) Idle: Part load: Full load: Minimum quantity with max. air-flow sensor plate deflection:	Setting: (cm ³ /min) 6,0 40,0 100,0 140 cm ³ /min	Max. perm. quantity: (cm ³ /min) 6,6 42,8 109,0

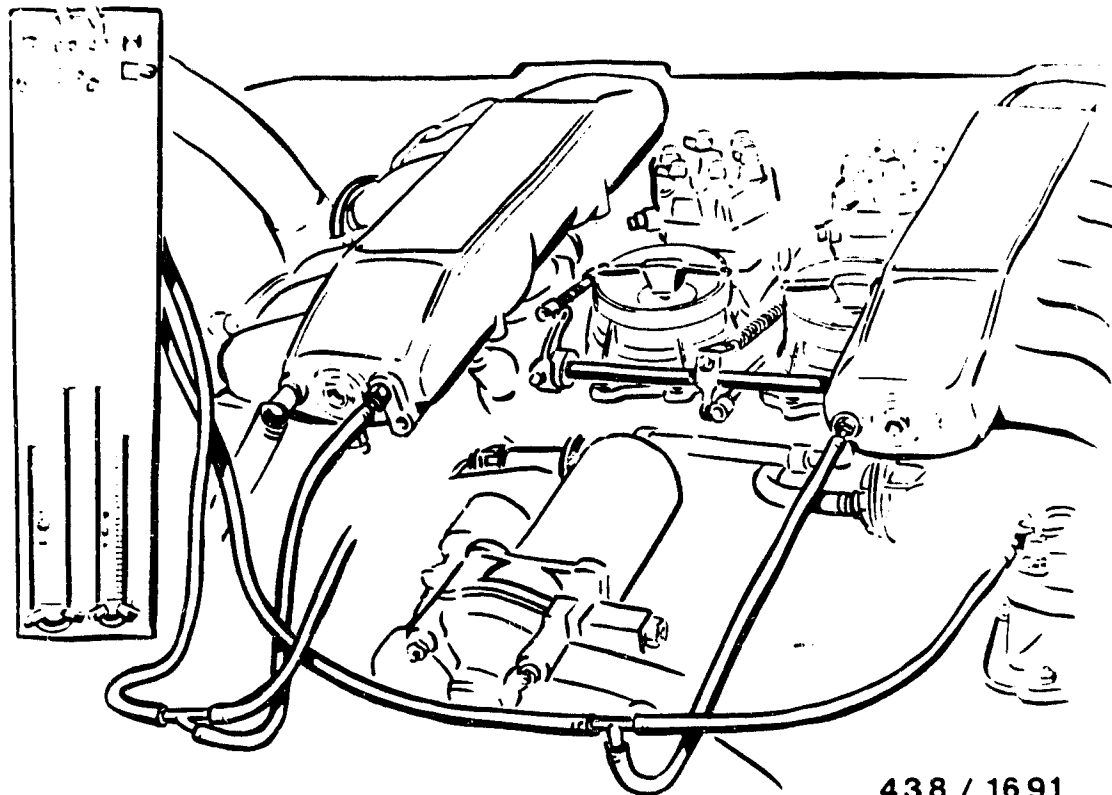


p₁ = Primary pressure
p₂ = Lower-chamber pressure
I = Actuator current



TEST SPECIFICATIONS (CONTINUED)

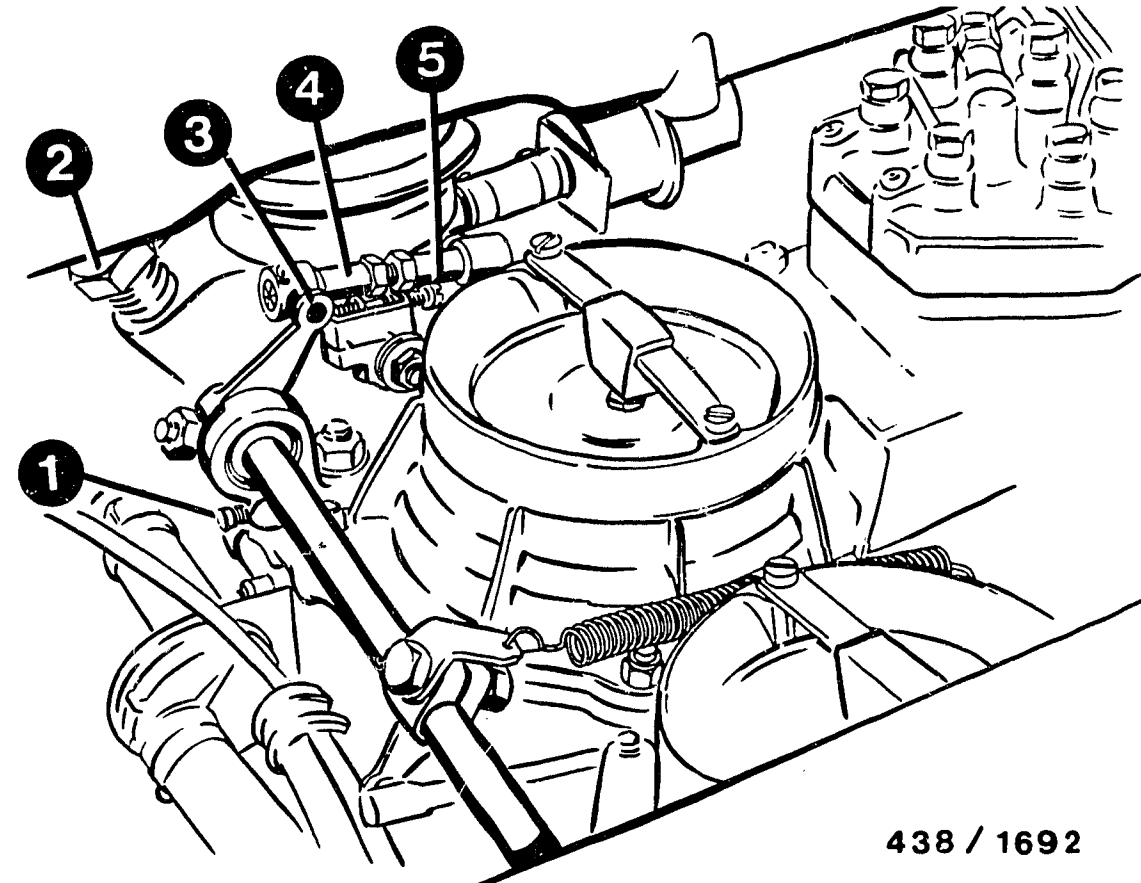
No.	Test/Test conditions	Set values	
7	Flow rate, KE restriction:	130...145 cm ³ /min	
8	Engine temperature sensor (NTC): Cold engine (+15...+30°C): Warm engine (approx. +80°C):	1,3...3,6 k Ω 250...390 Ω	
9	Thermo-time switch - resistance measurement:	Below +30°C	Above +40°C
	Terminal G and ground:	50...70 Ω	50...70 Ω
	Terminal W and ground:	0 Ω	infinity Ω
	Terminal G and terminal W:	50...70 Ω	infinity Ω
10	Idle-mixture-adjusting screw - basic setting:		
	Fuel-distributor seat - needle bearing:	20,9...21,6 mm	
11	Air-flow-sensor potentiometer:		
	Voltage signal, sensor-plate basic setting:	0,2... 0,3 V	
12	Idle-speed adjustment:		
	Idle speed:	900...1100 min ⁻¹	
	CO content: (per cylinder bank)	0,8... 1,0 vol.%	



TEST SPECIFICATIONS (CONTINUED)

If the throttle-valve linkage has been removed or if its setting has clearly been altered, perform basic adjustment of the throttle valves with engine at operating temperature.

1. To synchronize both cylinder banks, connect a synchronisation tester to the intake manifold using two T-connectors (see top picture).
2. Check whether the two arms (3) are opposite one another and in parallel (see picture on next coordinate).
 - Screw in both screws (5) halfway.
 - Remove transmission rod (4) on one side.
 - Completely close bypass screws (2).
 - Detach throttle-valve switch and jumper idle contact.



TEST SPECIFICATIONS (CONTINUED)

3. Start engine and set to 700 min⁻¹ with screws (1). Ensure uniform vacuum in both cylinder banks.
4. Switch off engine and connect transmission rod (4) such that there is no play.
5. Start engine and hold it at 2000 min⁻¹ ; if necessary, equalize vacuum by means of screws (5).
6. Check vacuum again at 700 min⁻¹ and equalize if necessary by means of screws (1).
7. Use the two bypass screws to set idle speed of 900...1100 min⁻¹ , taking care to ensure uniform vacuum. Re-attach and adjust throttle-valve switch.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER
ETT 018.01 WITH KE2 ADAPTER CABLE 1 684 463 135 AND
SUITABLE MULTIMETER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic specialist to rapidly test the electrical/electronic peripheral and control-unit functions of the KE-Jetronic, including lambda closed-loop control.

Important information concerning the following rapid diagnosis chart:

The "test conditions" column specifies the test steps during which the control-unit plug must be connected or disconnected. Great care must be taken to ensure that the system is without current during all plugging and unplugging operations, i.e. the ignition must be switched off and the electrical safety circuit must not be bridged.

The "test connections" column indicates the leads in the current path for the measurement being made, with reference to the pin assignment of the control-unit plug. Any trouble-shooting that may be required will involve these leads.

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

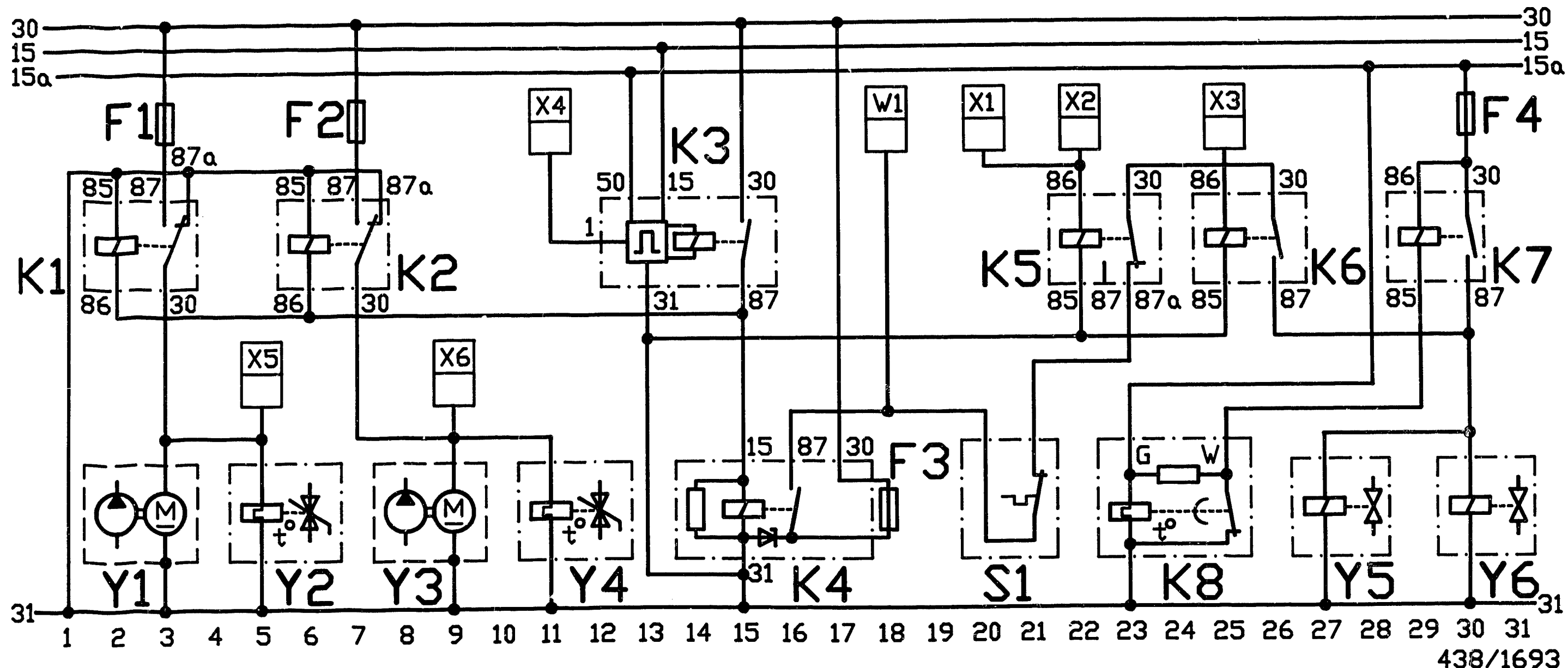
No.	Switch/btn V	Ω		Testing of	Test pins	Test conditions	Set values
1	 V	4	-	Pressure actuator - internal resistance	12-10	Detach control-unit plug.	20... 30 Ω
2	 V	5	-	Engine temperature sensor	21- 2	Engine temperature +15...+30°C; approx. +80°C:	1,3...3,6 k Ω 250...390 Ω
3	 V	9	-	Idle throttle-valve switch	13- 2	C a u t i o n : Voltage measurement; connection of voltmeter: Negative = Black socket "V", Positive = Left-hand blue socket " Ω ". Connect term. 30 and 87 of over-voltage protection relay. Throttle valve closed: Throttle valve open:	8... 15 V 0 V
4	 V	10	-	Full-load throttle-valve switch	5- 2	C a u t i o n : Voltage measurement; connection of voltmeter: Negative = Black socket "V", Positive = Left-hand blue socket " Ω ". Connect term. 30 and 87 of over-voltage protection relay. Throttle valve closed: Throttle valve fully open:	0 V 8... 15 V
5	4	-	-	Starting signal, terminal 50	24- 2	Actuate starting motor:	8... 15 V
6	5	-	-	TD signal, ignition	25- 2	Actuate starting motor for several seconds:	Voltage value undefined
7	6	-	-	Control unit - supply	1-2	Connect term. 30 and 87 of over-voltage protection relay:	8... 15 V
8	7	-	-	Supply, potentiometer Air-flow sensor and altitude sensor	18-14	Connect control unit. Connect term. 30 and 87 of over-voltage protection relay:	7... 8 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/ V	btn Ω	Testing of component/ function		Test instructions/ test conditions	Set values
9	8	-	-	Signal, potentiometer Air-flow sensor	17-14 Connect term. 30 and 87 of over-voltage protection relay. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous voltage increase up to max.:	Approx. 0 V 7... 8 V
10	12	-	-	Signal, altitude sensor	11-14 Connect term. 30 and 87 of over-voltage protection relay. Signal is altitude-dependent. 0 meters: (sea level) 500 meters: 1000 meters: 2000 meters: 3000 meters:	Approx. 6,5 V Approx. 5,6 V Approx. 4,8 V Approx. 3,2 V Approx. 2,0 V
11	-	21	1	Warm-up enrichment - 20°C	12-12 Current measurement! Ammeter connection: Negative = Black socket 1, Positive = Black socket 2. Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Current value with button 1 pressed:	46...66 mA
12	-	21	2	Actuator current Engine at operating temperature	12-12 Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Current value with button 2 pressed:	10 mA
13	-	21	2 4	Starting enrichment	12-12 Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Keep button 2 pressed. With button 4 pressed, current increase (approx. 1 s) to:	> 80 mA
14	-	21	1 4	Post-start enrichment	12-12 Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Keep button 1 pressed. Current value: Briefly press button 4. Current increase to: Following brief dwell time, regulation to:	46...66 mA > 100 mA 46...66 mA

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/ V	btn Ω	Testing of		Test conditions	Set values
15	-	21	1 6	Acceleration enrichment	12-12 Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Keep buttons 1 and 6 pressed. Current value: Rapidly deflect air-flow sensor plate. Current increase to: Regulation approx. 1 second to:	46...66 mA > 100 mA 46...66 mA
16	-	21	-	Full-load enrichment	12-12 Detach connector at altitude sensor. Start engine and hold speed n at approx.: Actuate full-load throttle-valve switch. Current increase to:	3200 min $^{-1}$ 12...16 mA
17	-	24	-	Lambda closed-loop control Closed-loop operation	12-12 Detach connector at altitude sensor. Engine at operating temperature, idling. Closed-loop operation can be seen from fluctuating current reading. Mean value: If mean value not within tolerance, adjust (idle-mixture-adjusting screw) to approx.:	8...12 mA 10 mA
18	-	22	-	Lambda closed-loop control Rich stop	12-12 Detach connector at altitude sensor. Engine at operating temperature, idling. Current increase to:	20 mA
19	-	23	-	Lambda closed-loop control Lean stop	12-12 Detach connector at altitude sensor. Engine at operating temperature, idling. Current decrease to:	0 mA
20	-	21	-	Overrun cutoff	Reconnect ammeter (interchange positive and negative). Briefly increase engine speed to 3000 min $^{-1}$. Current reading during decreasing engine-speed phase: (Idle throttle-valve switch closed)	-30...-60 mA



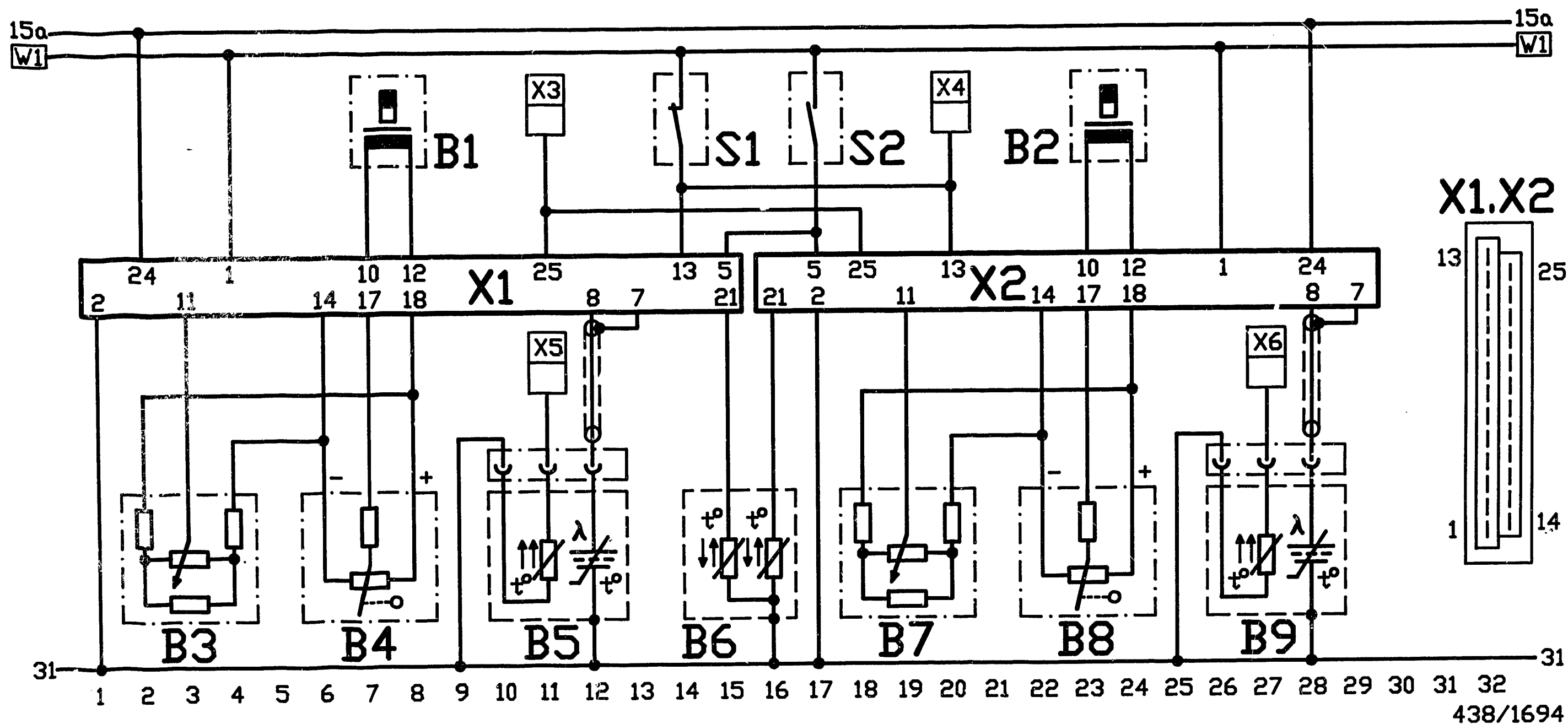
438/1693

F1 = Fuse 16 A
 F2 = Fuse 16 A
 F3 = Fuse 10 A
 F4 = Fuse 8 A
 K1 = Electric-fuel-pump relay 1
 K2 = Electric-fuel-pump relay 2
 K3 = Engine-speed relay
 K4 = Over-voltage protection relay
 K5 = Distributor relay for acceleration enrichment

K6 = Control relay for acceleration enrichment by start valves
 K7 = Control relay for start valves
 K8 = Thermo-time switch
 S1 = Thermo-switch
 W1 = Lead to control unit and throttle-valve switches
 X1 = Connection, control unit, terminal 13
 X2 = Connection, ign. trigger box, term. 19
 X3 = Connection, ign. trigger box, term. 20

X4 = Connection, ignition coil, term. 1
 X5 = Connection, lambda sensor heater 1
 X6 = Connection, lambda sensor heater 2
 Y1 = Electric fuel pump 1
 Y2 = Auxiliary-air device 1
 Y3 = Electric fuel pump 2
 Y4 = Auxiliary-air device 2
 Y5 = Start valve 1
 Y6 = Start valve 2

ELECTRICAL TERMINAL DIAGRAM



B1 = Pressure actuator 1
 B2 = Pressure actuator 2
 B3 = Altitude sensor 1
 B4 = Air-flow-sensor potentiometer 1
 B5 = Lambda sensor 1
 B6 = Temperature sensor (coolant)
 B7 = Altitude sensor 2

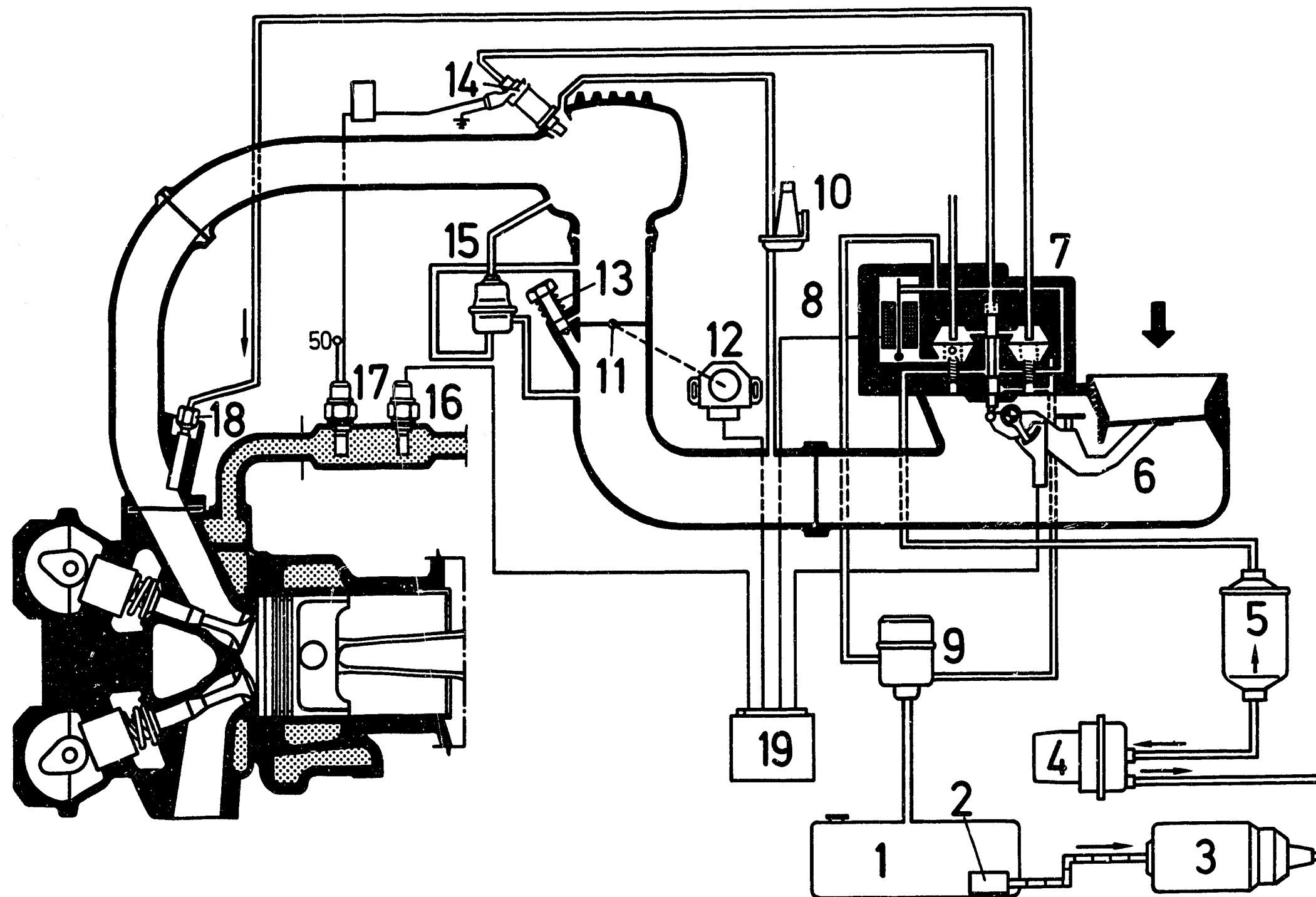
B8 = Air-flow-sensor potentiometer 2
 B9 = Lambda sensor 2
 S1 = Idle throttle-valve switch
 S2 = Full-load throttle-valve switch
 W1 = Lead to over-voltage protection
 relay, terminal 87
 X1 = Plug, KE control unit 1

X2 = Plug, KE control unit 2
 X3 = Connection, ign. trigger box, term. 24
 X4 = Connection, distributor relay for
 acceleration enrichment
 X5 = Connection, EFP relay 1, terminal 30
 X6 = Connection, EFP relay 2, terminal 30

ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

A21 ————— <==>

A22 ————— <==>



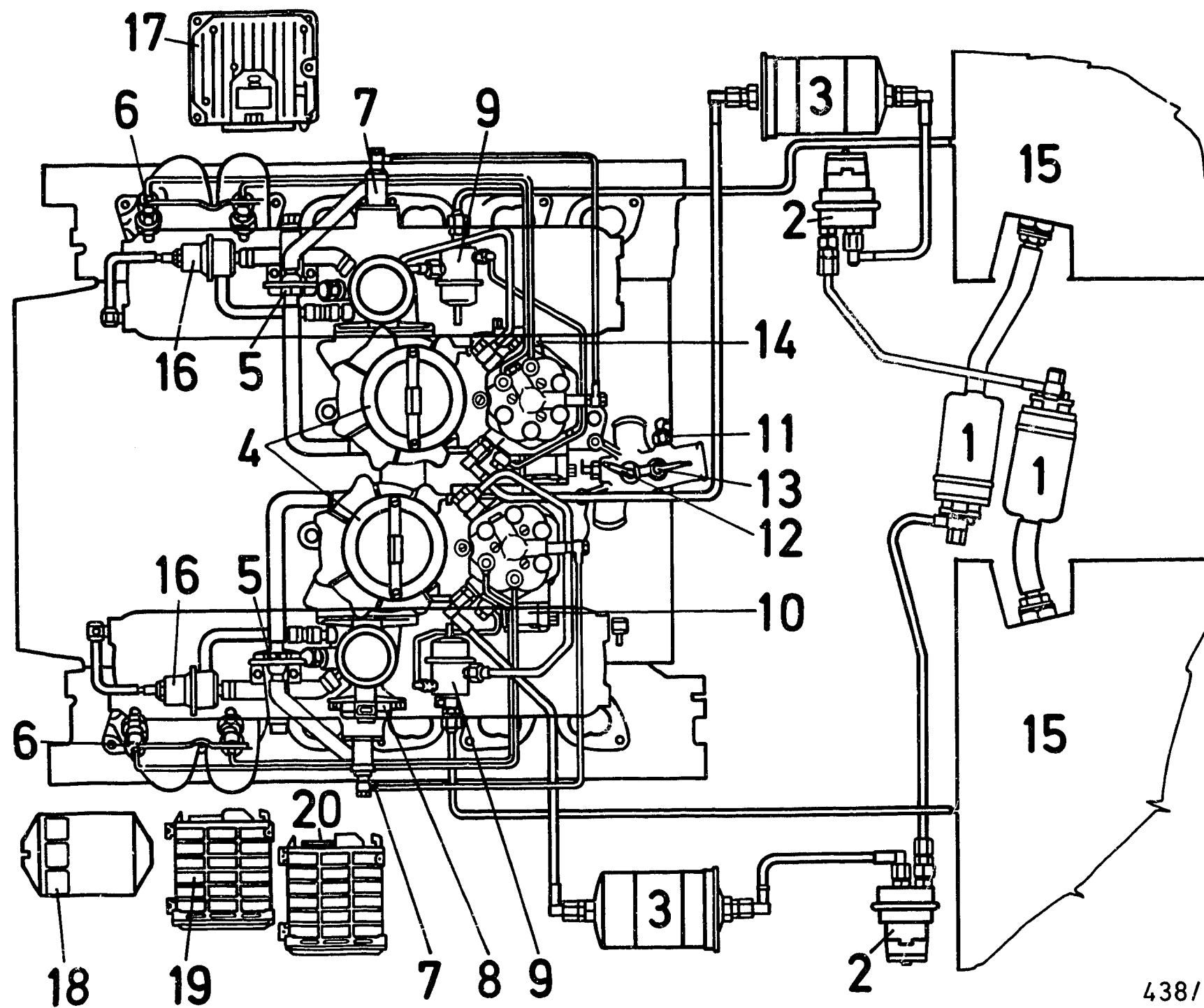
438 / 1695

- 1 = Fuel tank
- 2 = Intake filter
- 3 = Electric fuel pump
- 4 = Fuel accumulator
- 5 = Fuel filter
- 6 = Air-flow sensor
- 7 = Fuel distributor

- 8 = Pressure actuator
- 9 = Pressure regulator
- 10 = Auxiliary-air device
- 11 = Throttle valve
- 12 = Throttle-valve switch
- 13 = Bypass screw
- 14 = Start valve

- 15 = Vacuum limiter
- 16 = Temperature sensor (coolant)
- 17 = Thermo-time switch
- 18 = Injection valve
- 19 = KE control unit

DIAGRAM OF AIR PIPES AND FUEL LINES



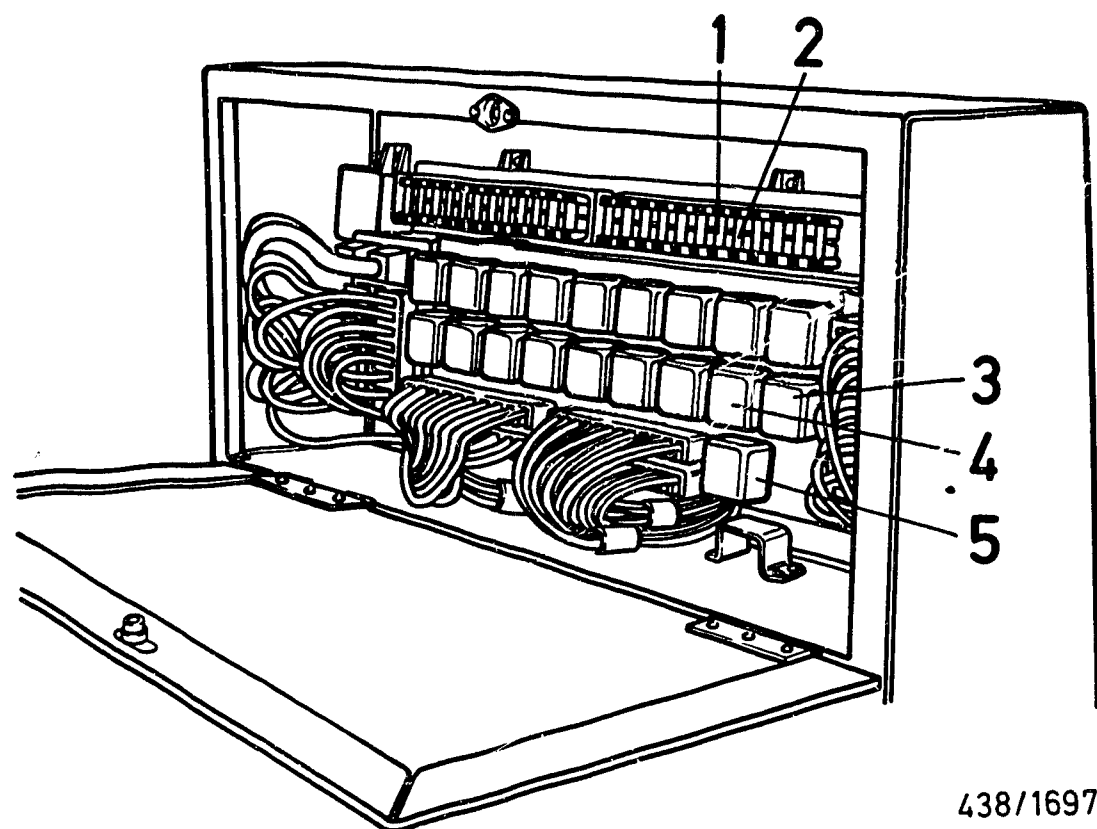
438/1696

1 = Electric fuel pumps
2 = Fuel accumulator
3 = Fuel filter
4 = Mixture-control unit
5 = Auxiliary-air device
6 = Injection valve
7 = Start valves

8 = Throttle-valve switch
9 = Pressure regulator
10 = Pressure actuator
11 = Thermo-switch
12 = Thermo-time switch
13 = Temperature sensor (coolant)
14 = Air-flow-sensor potentiometer

15 = Fuel tank
16 = Vacuum limiter
17 = Ignition control unit
18 = Relay plate with over-voltage protection relay
19 = KE control unit for 1-6 cyl.
20 = KE control unit for 7-12 cyl.

INSTALLATION POSITION OF COMPONENTS



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INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Fuse box is located in trunk behind a cover.

- 1 = Fuse 16 A for left-hand electric fuel pump
- 2 = Fuse 16 A for right-hand electric fuel pump
- 3 = Electric-fuel-pump relay (left)
- 4 = Electric-fuel-pump relay (right)
- 5 = Relay for start valves

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : FER-5002
BOSCH system : KE-Jetronic 1.2
Make of vehicle : FERRARI
Basic microcard : MB-505

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

FERRARI Testarossa (EU) 07.86->
with 5.0 l / 12-cyl. engine
270 kW (368 bhp)

- * KE-Jetronic 1.2
- * Start valves provide additional acceleration enrichment at engine temperatures below 63°C.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

A detailed trouble-shooting description is given in the trouble-shooting chart in the similar detailed instructions.

NOTE : Even if reference is made to similar detailed instructions, the set values, terminal designations and special features in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Always pay attention to the information given in the similar detailed instructions, so as to avoid injuries to people and to prevent damage to engine, trigger boxes and control units or ignition system.

CAUTION!

Heavy duty ignition system with hazardous high and low tension!

Coming into contact with live parts or terminals can be fatal (on both primary and secondary side).

When testing compression, detach pump relay, so as to avoid unwanted injection of the injection valves.

Important information regarding work on the KE-Jetronic.

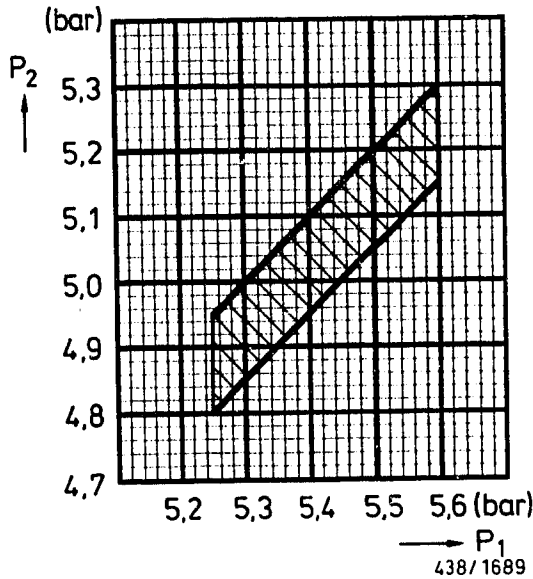
If any fuel connections are detached or parts removed (including on vacuum system), then new gaskets are always to be fitted when re-connecting or re-attaching.

Always maintain utmost cleanliness when working on the KE-Jetronic. The outsides of fuel connections are to be thoroughly cleaned prior to disconnection.

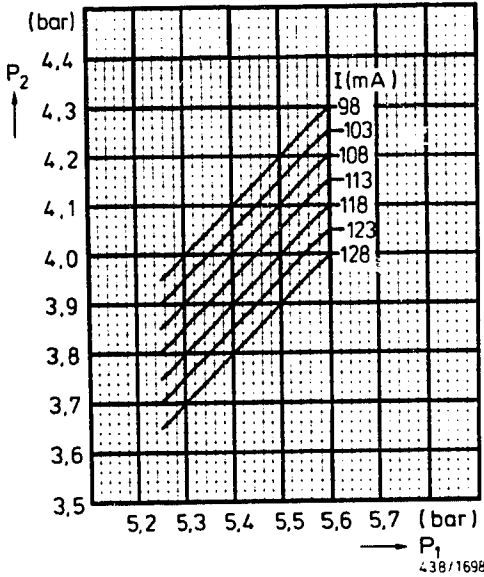
When performing tests with the electric fuel pump running, never deflect (raise) the sensor plate of the air-flow sensor as this causes fuel to be injected via the injection valves. Such procedure can lead to extremely severe engine damage when the engine is subsequently started.

TEST SPECIFICATIONS

No.	Test/Test conditions	Set values	
1	Electric fuel pump – delivery per pump:	min. 1450 cm ³ /min	
2	System pressure:	5,25...5,6 bar	
3	Differential pressure: Take lower-chamber-pressure set value "warm" in accordance with measured system pressure from top diagram. (Actuator current 8 mA) Take lower-chamber-pressure set value "cold" in accordance with measured system pressure and actuator current from lower diagram. Tolerance ± 0.15 bar. Simulation of "cold" condition: Detach connector at engine temperature sensor.		
4	Leak test – entire system: Minimum pressure after 10 min.: Minimum pressure after 20 min.:	2,9 bar 2,8 bar	
5	Injection valves – opening pressure:	3,0...4,1 bar	
6	Delivery – comparative measurement: (Actuator current 8 mA) Idle: Part load: Full load: Minimum quantity with max. air-flow sensor plate deflection:	Setting: (cm ³ /min) 6,0 40,0 100,0	Max. perm. quantity: (cm ³ /min) 6,6 42,8 109,9 140 cm ³ /min

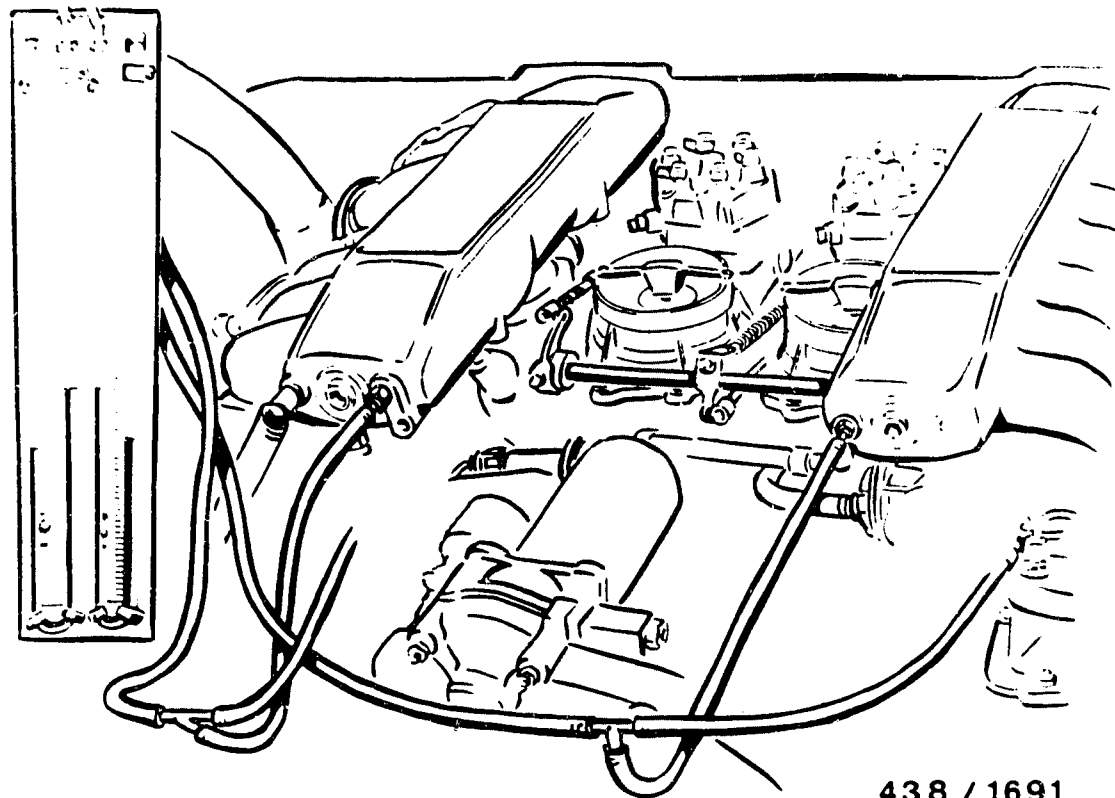


p₁ = Primary pressure
p₂ = Lower-chamber pressure
I = Actuator current



TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test conditions	Set values								
7	Flow rate, KE restriction:	130...145 cm ³ /min								
8	Engine temperature sensor (NTC): Cold engine (+15...+30°C): Warm engine (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω								
9	Thermo-time switch – resistance measurement: Terminal G and ground: Terminal W and ground: Terminal G and terminal W:	<table><tr><th>below +30°C</th><th>above +40°C</th></tr><tr><td>40...60 Ω</td><td>50... 70 Ω</td></tr><tr><td>0 Ω</td><td>240...300 Ω</td></tr><tr><td>40...60 Ω</td><td>180...240 Ω</td></tr></table>	below +30°C	above +40°C	40...60 Ω	50... 70 Ω	0 Ω	240...300 Ω	40...60 Ω	180...240 Ω
below +30°C	above +40°C									
40...60 Ω	50... 70 Ω									
0 Ω	240...300 Ω									
40...60 Ω	180...240 Ω									
10	Idle-mixture-adjusting screw – basic adjustment: Fuel-distributor seat – needle bearing:	 20,9...21,6 mm								
11	Air-flow-sensor potentiometer: Voltage signal, air-flow sensor plate basic setting:	 0,2... 0,3 V								
12	Idle-speed adjustment: Idle speed: CO content: (per cylinder bank)	 900...1100 min ⁻¹ 0,73...0,77 vol. %								

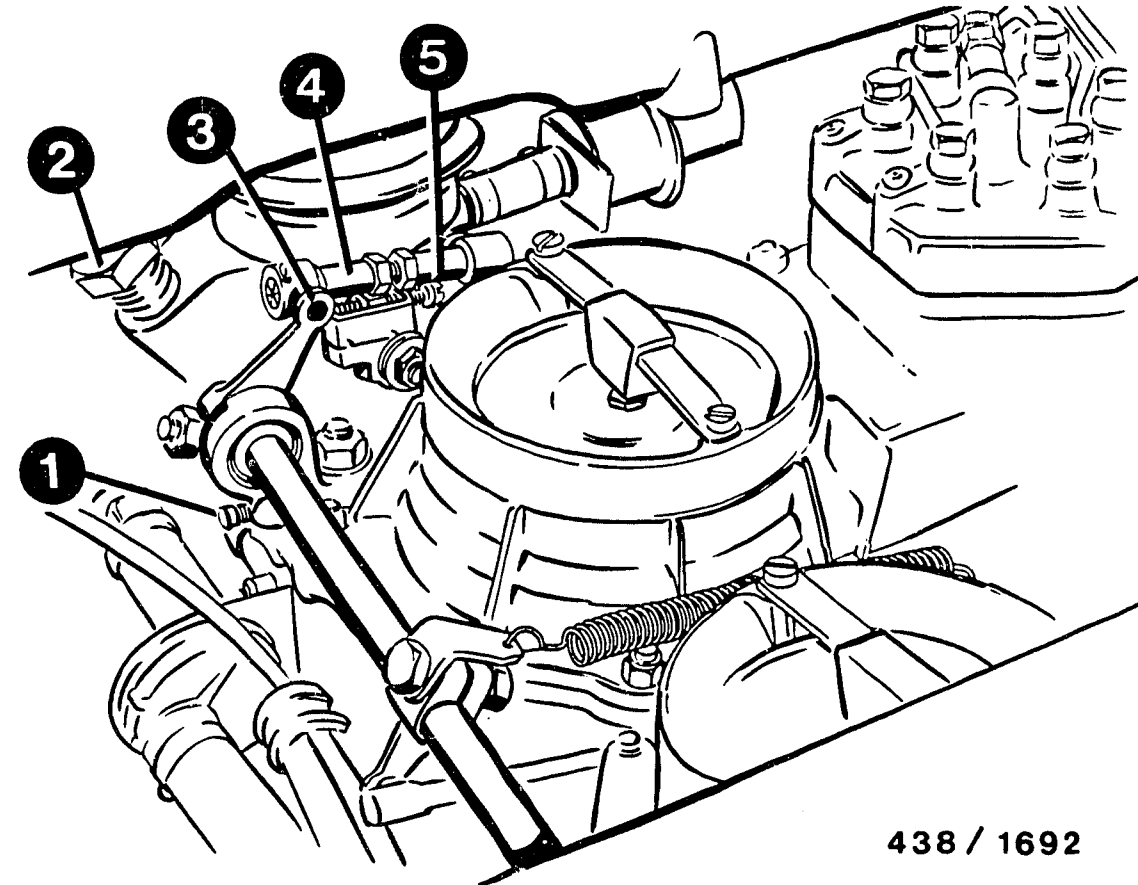


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TEST SPECIFICATIONS (CONTINUED)

If the throttle-valve linkage has been removed or if its setting has clearly been altered, perform basic adjustment of the throttle valves with engine at operating temperature.

1. To synchronize both cylinder banks, connect a synchronisation tester to the intake manifold using two T-connectors (see top picture).
2. Check whether the two arms (3) are opposite one another and in parallel (see picture on next coordinate).
 - Screw in both screws (5) halfway.
 - Remove transmission rod (4) on one side.
 - Completely close bypass screws (2).
 - Detach throttle-valve switch and jumper idle contact.



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TEST SPECIFICATIONS (CONTINUED)

3. Start engine and set to 700 min⁻¹ with screws (1). Ensure uniform vacuum in both cylinder banks.
4. Switch off engine and connect transmission rod (4) such that there is no play.
5. Start engine and hold it at 2000 min⁻¹ ; if necessary, equalize vacuum by means of screws (5).
6. Check vacuum again at 700 min⁻¹ and equalize if necessary by means of screws (1).
7. Use the two bypass screws to set idle speed of 900...1100 min⁻¹ , taking care to ensure uniform vacuum.
Re-attach and adjust throttle-valve switch.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER
ETT 018.01 WITH KE2 ADAPTER CABLE 1 684 463 135 AND
SUITABLE MULTIMETER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic specialist to rapidly test the electrical/electronic peripheral and control-unit functions of the KE-Jetronic, including lambda closed-loop control.

Important information concerning the following rapid diagnosis chart:

The "test conditions" column specifies the test steps during which the control-unit plug must be connected or disconnected. Great care must be taken to ensure that the system is without current during all plugging and unplugging operations, i.e. the ignition must be switched off and the electrical safety circuit must not be bridged.

The "test connections" column indicates the leads in the current path for the measurement being made, with reference to the pin assignment of the control-unit plug. Any trouble-shooting that may be required will involve these leads.

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

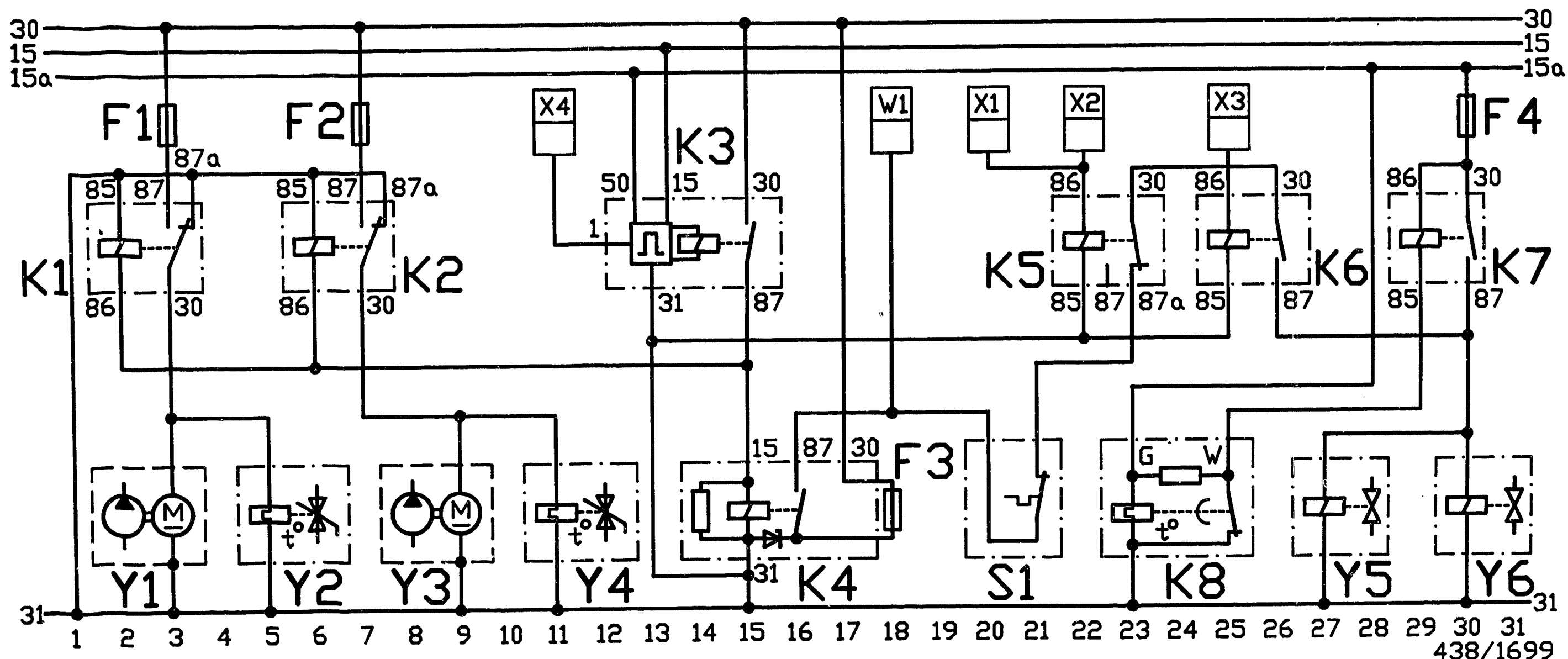
No.	Switch/btn V	Ω		Testing of	Test pins	Test conditions	Set values
1	 V	4	-	Pressure actuator - internal resistance	12-10	Detach control-unit plug.	20... 30 Ω
2	 V	5	-	Engine temperature sensor	21- 2	Engine temperature +15...+30°C; approx. +80°C;	1,3...3,6 k Ω 250...390 Ω
3	 V	9	-	Idle throttle-valve switch	13- 2	C a u t i o n : Voltage measurement; connection of voltmeter: Negative = Black socket "V", Positive = Left-hand blue socket " Ω " Connect terminals 30 and 87 of over-voltage protection relay. Throttle valve closed: Throttle valve open:	8... 15 V 0 V
4	 V	10	-	Full-load throttle-valve switch	5- 2	C a u t i o n : Voltage measurement; connection of voltmeter: Negative = Black socket "V", Positive = Left-hand blue socket " Ω ". Connect terminals 30 and 87 of over-voltage protection relay. Throttle valve closed: Throttle valve fully open:	0 V 8... 15 V
5	4	-	-	Starting signal, terminal 50	24- 2	Actuate starting motor:	8... 15 V
6	5	-	-	TD signal, ignition	25- 2	Actuate starting motor for several seconds:	Voltage value undefined

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/ V	btn Ω	Testing of component/ function		Test instructions/ test conditions	Set values
7	6	-	-	Control unit - supply	1-2 Connect terminals 30 and 87 of over-voltage protection relay:	8...15 V
8	7	-	-	Supply - potentiometer Air-flow sensor and altitude sensor	18-14 Connect control unit. Connect terminals 30 and 87 of over-voltage protection relay:	7... 9 V
9	8	-	-	Signal, potentiometer Air-flow sensor	17-14 Connect term. 30 and 87 of over-voltage protection relay. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous voltage increase up to max.:	Approx. 0 V 7... 9 V
10	13	-	-	Signal, altitude sensor	11-14 Connect term. 30 and 87 of over-voltage protection relay. Signal is altitude-dependent. 0 meters (sea level): 500 meters: 1000 meters: 2000 meters: 3000 meters:	approx. - V approx. - V approx. - V approx. - V approx. - V
11	-	21	1	Warm-up enrichment - 20°C	12-12 Current measurement! Ammeter connection: Negative = Black socket 1, Positive = Black socket 2. Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Current value with button 1 pressed:	78...88 mA
12	-	21	2	Actuator current Engine at operating temperature	12-12 Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Current value with button 2 pressed:	8 mA

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER 018.01 (CONTINUED)

No.	Switch/ V	btn Ω	Testing of		Test conditions	Set values
13	—	21	2 4 Starting enrichment	12-12	Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Keep button 2 pressed. Current increase with button 4 pressed (approx. 1 s) to:	80...100 mA
14	—	21	1 4 Post-start enrichment	12-12	Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Keep button 1 pressed. Current value: Briefly press button 4. Current increase to: After brief dwell time, regulation to:	78... 88 mA 130...145 mA 78... 88 mA
15	—	21	1 6 Acceleration enrichment	12-12	Detach connector at altitude sensor. Connect term. 30 and 87 of over-voltage protection relay. Keep buttons 1 and 6 pressed. Current value: Rapidly deflect sensor plate. Current increase to: Regulation approx. 1 second to:	78... 88 mA > 100 mA 78... 88 mA
16	—	21	— Full-load enrichment	12-12	Detach connector at altitude sensor. Start engine and hold speed n at approx.: Actuate full-load throttle-valve switch. Current increase to:	2500 min ⁻¹ 12... 16 mA

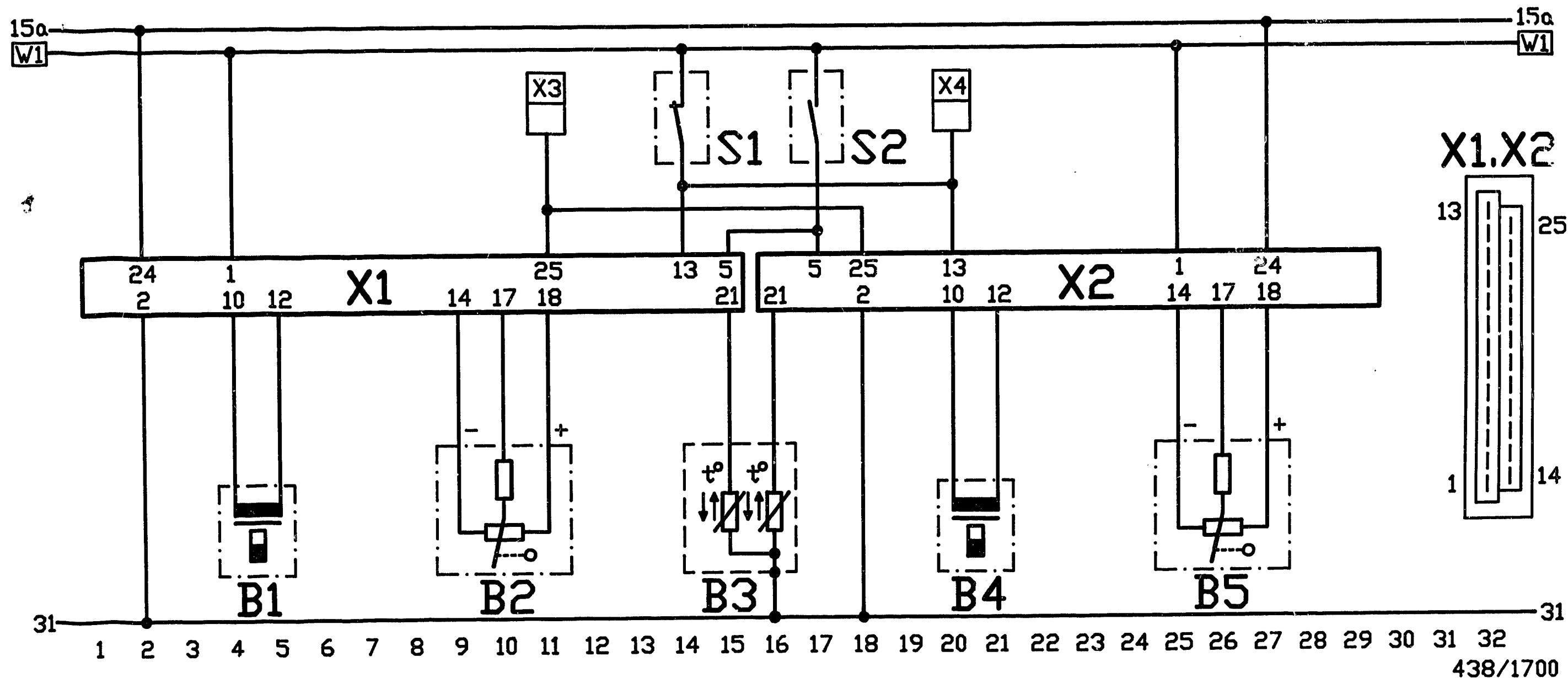


F1 = Fuse 16 A
 F2 = Fuse 16 A
 F3 = Fuse 10 A
 F4 = Fuse 8 A
 K1 = Electric-fuel-pump relay 1
 K2 = Electric-fuel-pump relay 2
 K3 = Engine speed relay
 K4 = Over-voltage protection relay
 K5 = Distributor relay for

Acceleration enrichment
 K6 = Control relay for acceleration
 enrichment by means of start valves
 K7 = Control relay for start valves
 K8 = Thermo-time switch
 S1 = Thermo-switch
 W1 = Lead to control unit and throttle-
 valve switches
 X1 = Connection, control unit, term. 13

X2 = Connection, ign. trigger box, term. 19
 X3 = Connection, ign. trigger box, term. 20
 X4 = Connection, ignition coil, term. 1
 Y1 = Electric fuel pump 1
 Y2 = Auxiliary-air device 1
 Y3 = Electric fuel pump 2
 Y4 = Auxiliary-air device 2
 Y5 = Start valve 1
 Y6 = Start valve 2

ELECTRICAL TERMINAL DIAGRAM



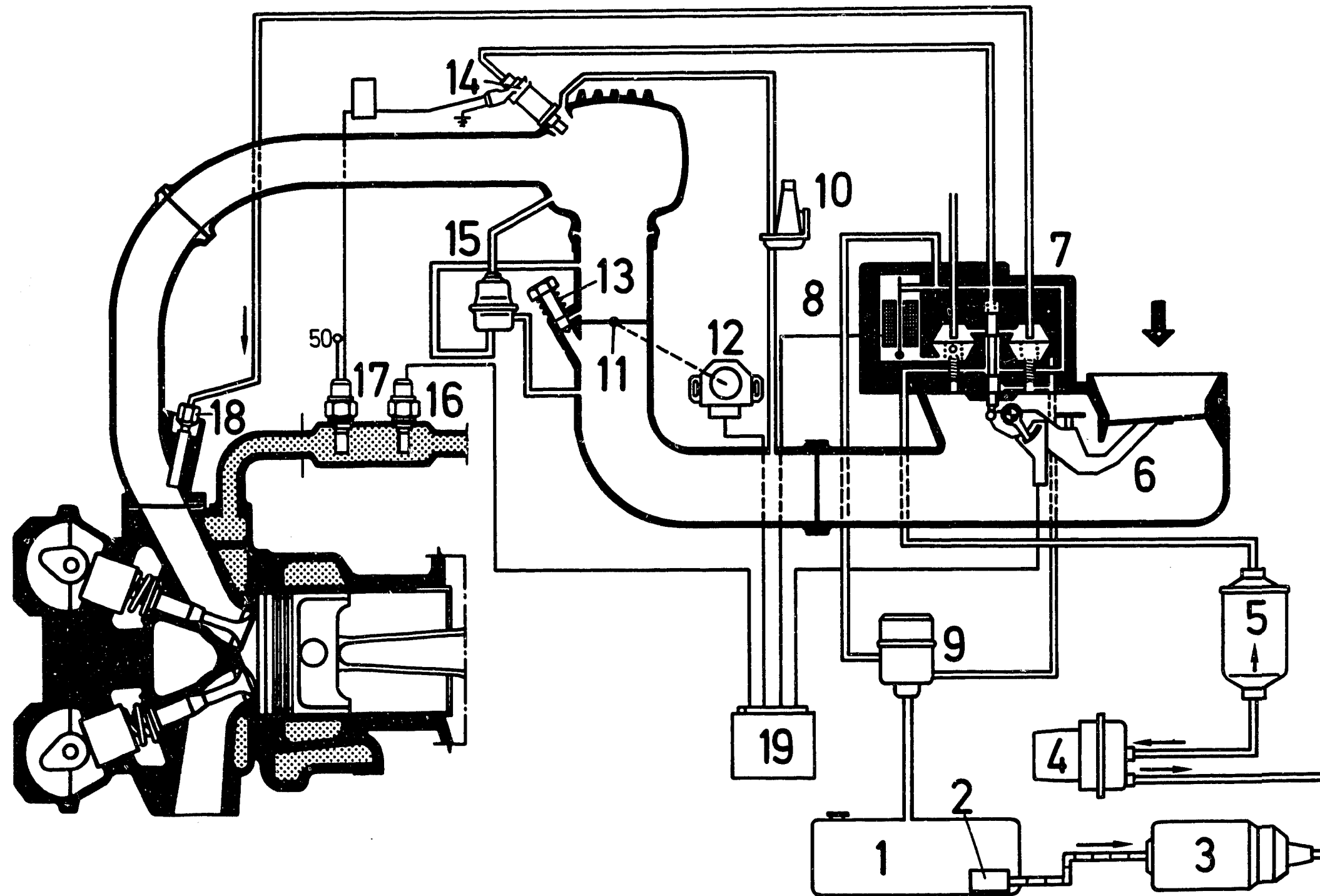
B1 = Pressure actuator 1
 B2 = Air-flow-sensor potentiometer 1
 B3 = Temperature sensor (coolant)
 B4 = Pressure actuator 2
 B5 = Air-flow-sensor potentiometer 2
 S1 = Idle throttle-valve switch
 S2 = Full-load throttle-valve switch

W1 = Lead to over-voltage protection relay, terminal 87
 X1 = Plug, KE control unit 1
 X2 = Plug, KE control unit 2
 X3 = Connection, ignition trigger box, terminal 24
 X4 = Connection, distributor relay for acceleration enrichment

ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

B21 ————— <==>

B22 ————— <==>



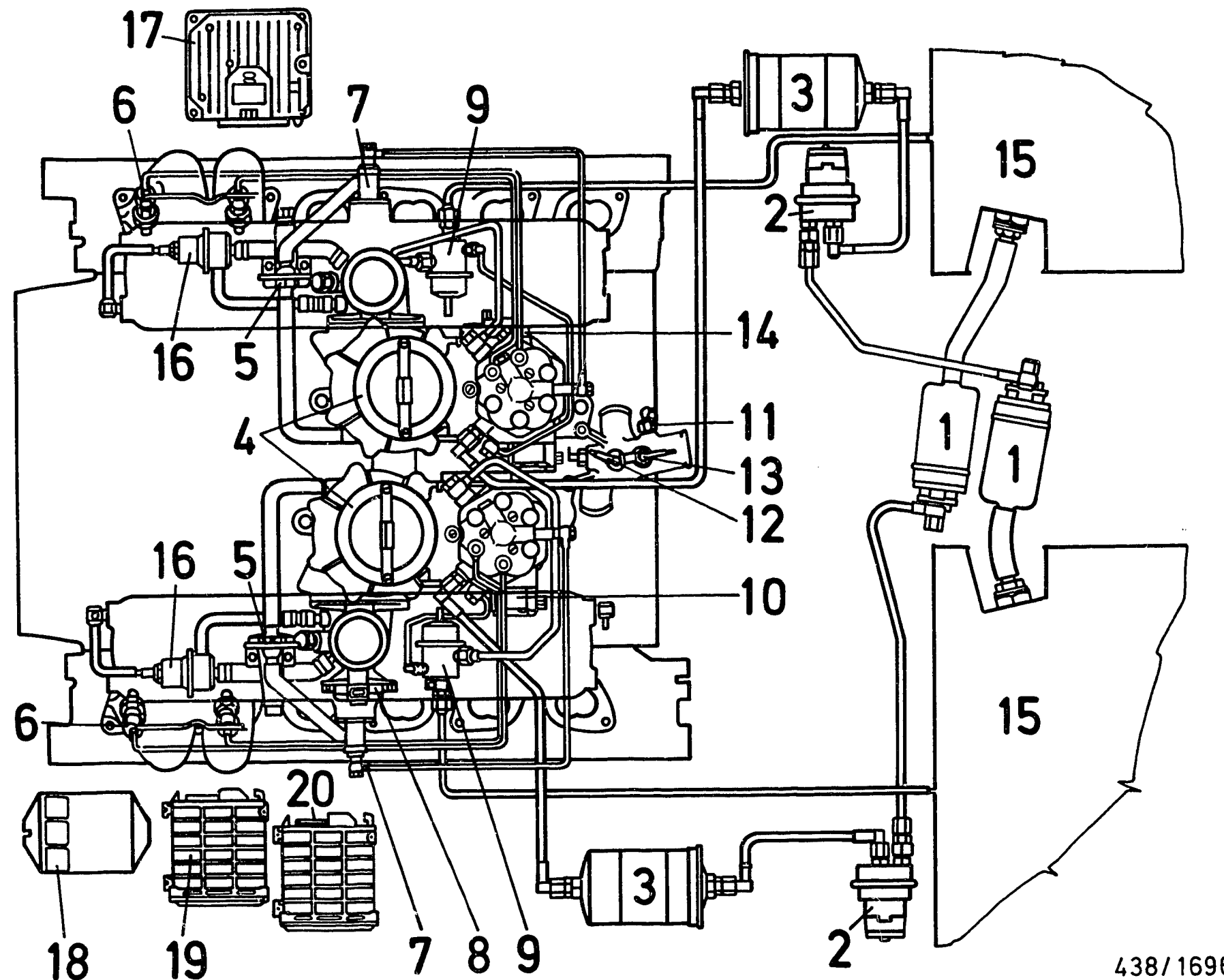
438/1695

- 1 = Fuel tank
- 2 = Intake filter
- 3 = Electric fuel pump
- 4 = Fuel accumulator
- 5 = Fuel filter
- 6 = Air-flow sensor
- 7 = Fuel distributor

- 8 = Pressure actuator
- 9 = Pressure regulator
- 10 = Auxiliary-air device
- 11 = Throttle valve
- 12 = Throttle-valve switch
- 13 = Bypass screw
- 14 = Start valve

- 15 = Vacuum limiter
- 16 = Temperature sensor (coolant)
- 17 = Thermo-time switch
- 18 = Injection valve
- 19 = KE control unit

DIAGRAM OF AIR PIPES AND FUEL LINES

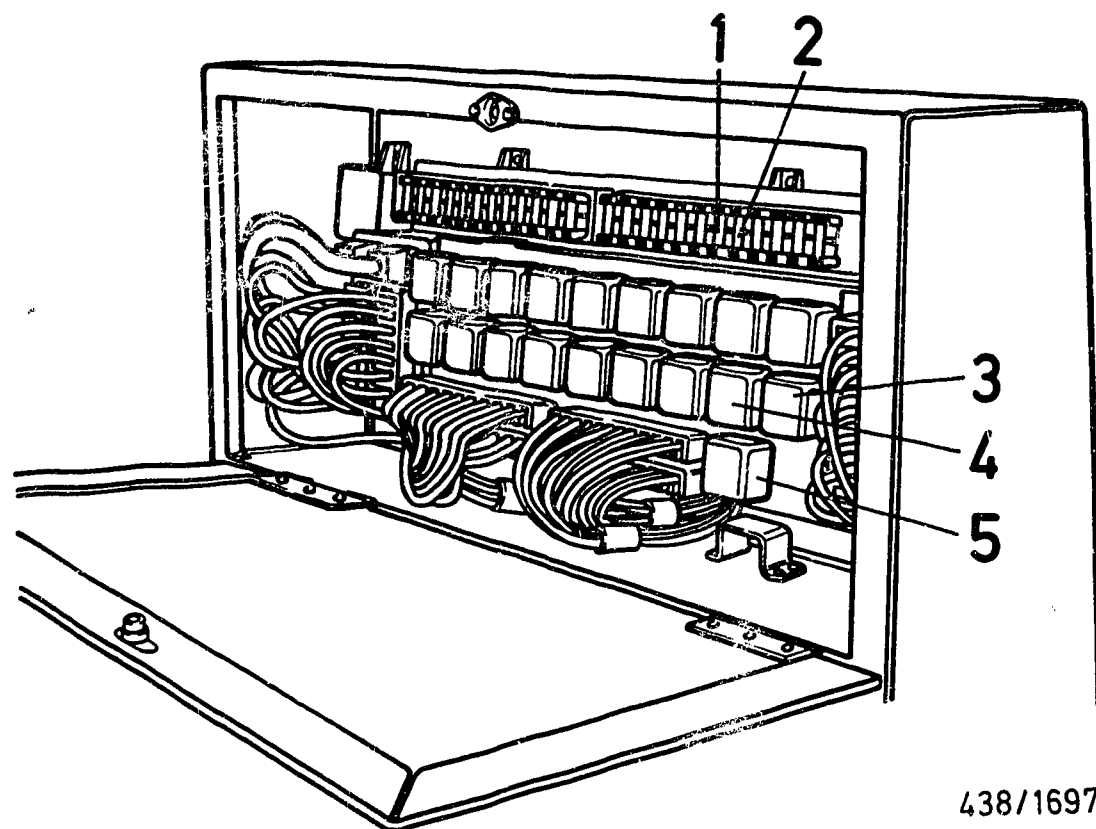


1 = Electric fuel pumps
 2 = Fuel accumulator
 3 = Fuel filter
 4 = Mixture-control unit
 5 = Auxiliary-air device
 6 = Injection valve
 7 = Start valves

8 = Throttle-valve switch
 9 = Pressure regulator
 10 = Pressure actuator
 11 = Thermo-switch
 12 = Thermo-time switch
 13 = Temperature sensor (coolant)
 14 = Air-flow-sensor potentiometer

15 = Fuel tank
 16 = Vacuum limiter
 17 = Ignition control unit
 18 = Relay plate with over-voltage protection relay
 19 = KE control unit for 1-6 cyl.
 20 = KE control unit for 7-12 cyl.

INSTALLATION POSITION OF COMPONENTS



438/1697

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Fuse box is located in trunk behind a cover.

- 1 = Fuse 16 A for left-hand electric fuel pump
- 2 = Fuse 16 A for right-hand electric fuel pump
- 3 = Electric-fuel-pump relay (left)
- 4 = Electric-fuel-pump relay (right)
- 5 = Relay for start valves

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : BMW-5020

BOSCH system : ABS

Make of vehicle : BMW

Basic microcard : PKW-040

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Test requirements	03
Rapid diagnosis chart	05
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SPECIAL FEATURES

This microcard, valid at the time of publication, contains trouble-shooting instructions for the following models:

BMW 5 Series (E 34) 1.1988->

- * ABS with 4 wheel-speed sensors and 4 hydraulic channels.
- * Sensor ring gears with 48 teeth.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

- * For safety reasons, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.
Exception: relays.
- * Do not loosen any screws on the hydraulic modulator!
Danger of fatal accident due to brake failure.
- * Caution when handling brake fluid.
Poisonous!

For further information, see basic instructions.

TEST PREREQUISITES WHEN USING ABS2-LED TESTER

- * Correct tire size fitted?
- * Check tightness of return-pump ground connection.
- * Check tightness of ground strap between engine block and vehicle frame.
- * Check hydraulic connections at hydraulic modulator and sealing points for leaks (visual inspection).
- * If the ABS warning lamp lights up from time to time when driving (e.g. after switching on loads) and goes out again of its own accord, check battery and voltage supply (alternator, regulator and voltage dips).
- * If ABS warning lamp lights up continuously and does not go out, check the following:
 - Is controller plug properly seated on controller and is it engaged?
 - All plug contacts O.K.?
 - Spring contacts engaged?
 - Check installation position of sealing ring in controller plug to ensure proper fit: curvature downwards.

- Check wheel-speed-sensor leads for correct assignment at controller plug:

Wheel-speed sensors:

front left to term. 6 and term. 4.
front right to term. 11 and term. 21.
rear left to term. 7 and term. 9.
rear right to term. 24 and term. 26.
rear axle to term. - and term. -.

- V-belt snapped?
(Alternator provides no voltage, charge-indicator lamp and ABS warning lamp light up).
- * Connect ABS 2 LED tester to ABS wiring harness.
- Disconnect and connect controller only with ignition switched off.
- For testing, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).
- Observe LED (green) for current supply in all program-selector-switch positions.

C A U T I O N !

Do not drive with tester connected!

The brake system must be bled of air before the ABS test. Do not activate the ABS tester while the system is being bled.

Repeat the complete test program after any repairs are carried out.

The Antiskid System is a vehicle safety system.

Work on the system demands detailed knowledge of the system.

The conventional brake system must be O.K.

General information for trouble-shooting:

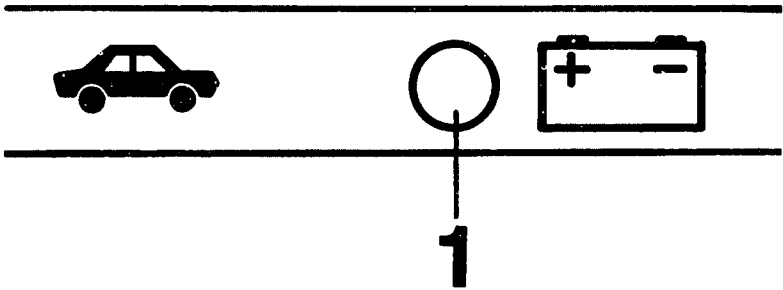
Check all leads for short circuit to ground and contact with positive leads and watch out for worn cable insulation and pinched leads.

RAPID DIAGNOSIS CHART

Never drive with tester connected! Have all test prerequisites been fulfilled?

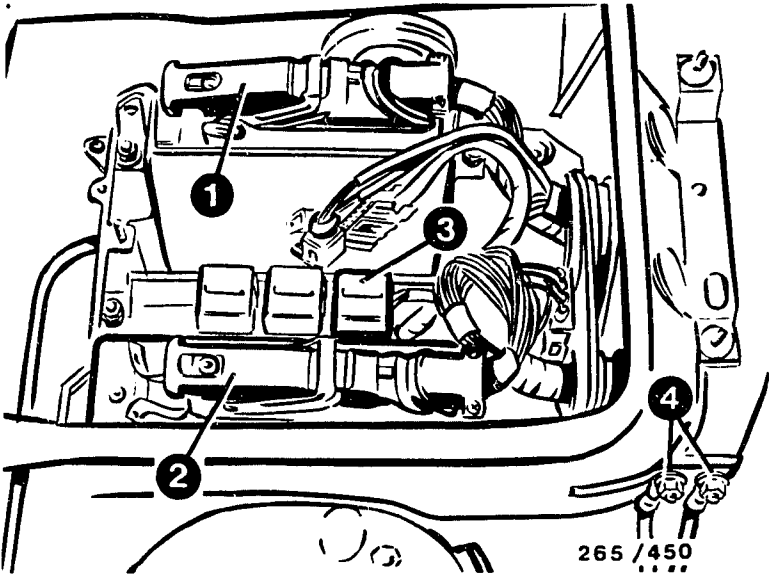
Program-selector-switch settings 1 - 6

Testing of (measurement at terminals)	Additional operation	Test specification (indication)	Possible causes of fault
Voltage supply (Term. 1 and term.20)	Ignition on	LED 1 (top picture) lights up continuously	<ul style="list-style-type: none">* Insufficient battery charge* Excessive voltage dips at ground and positive leads.* Check plug connections.* Check lead to Motronic relay, term. 87.* Motronic relay defective.



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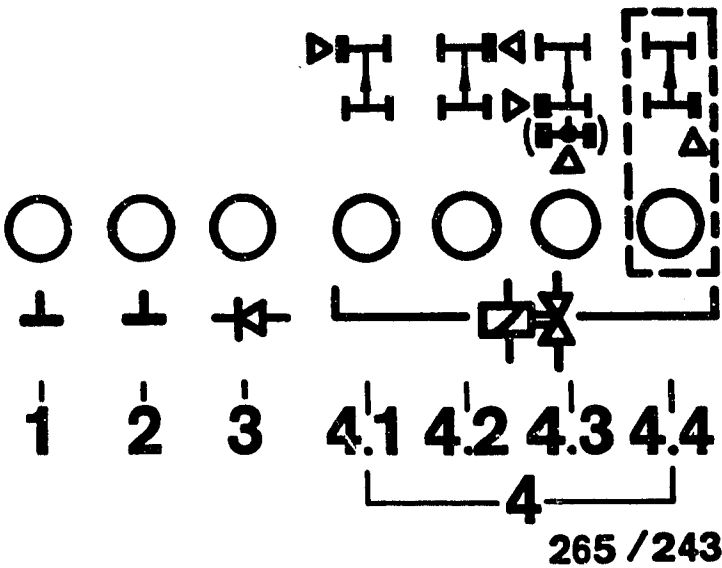
- 1 = Motronic control unit
- 2 = ABS controller
- 3 = Motronic relay
- 4 = Ground terminals



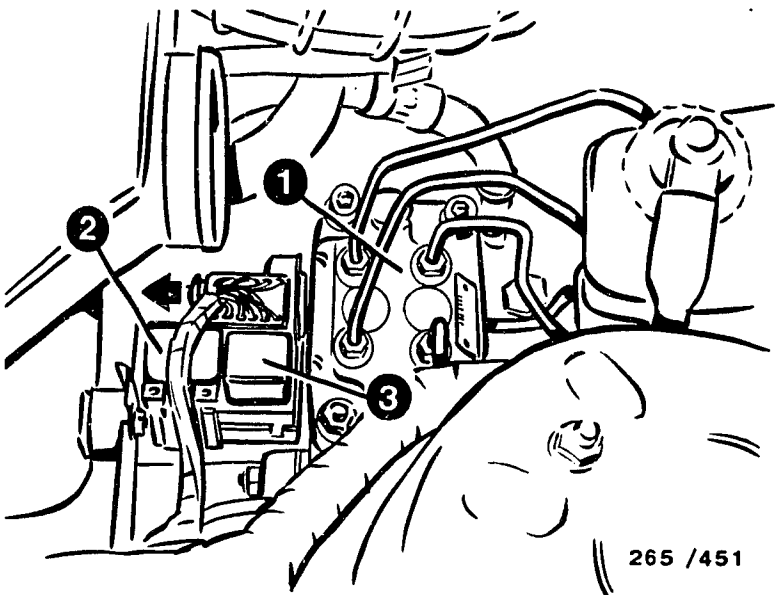
RAPID DIAGNOSIS CHART (CONTINUED)

Program-switch position 1 (4-channel hydraulic modulator)

Testing of (measurement at terminals)	Addition- al operation	Test specifi- cation (reading)	Possible causes of faults
Ground connection (term.10, term.34) Diode for warning lamp (term.29, term.32) Solenoid-operated valve internal res. (term. 2, term.18, term.19, term.35) Off-position and ground connection of relay ABS warning lamp	Ignition on	7 LED (1 to 4.4) simultaneously brightly lit (top picture) ABS warning lamp in vehicle must light up	<ul style="list-style-type: none">* LED 1 and/or 2 (top picture) not lit: Check ground terminals for open circuit.* LED 3 (top picture) not lit: Diode defective, check ground connection of valve relay.* One or more LEDs 4 not lit: Check corresponding plug-in connection for solenoid- operated valve and leads.Solenoid-operated valve internal resistance 0,7...1,7 Ω* All LEDs 4 and LEDs 3 not lit: Check ground connection of valve relay, valve relay defective.* Dimmer lighting-up of an LED means contact resistance in the corresponding circuit.* ABS warning lamp not lit: Warning lamp defective. Note: all other 6 LEDs lit.



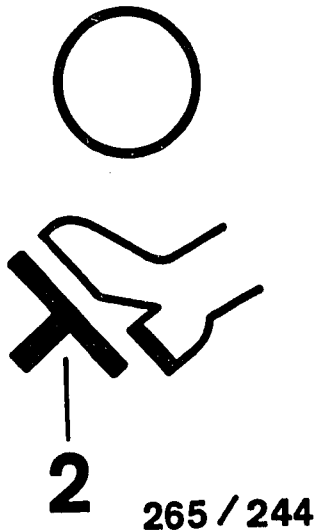
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 2

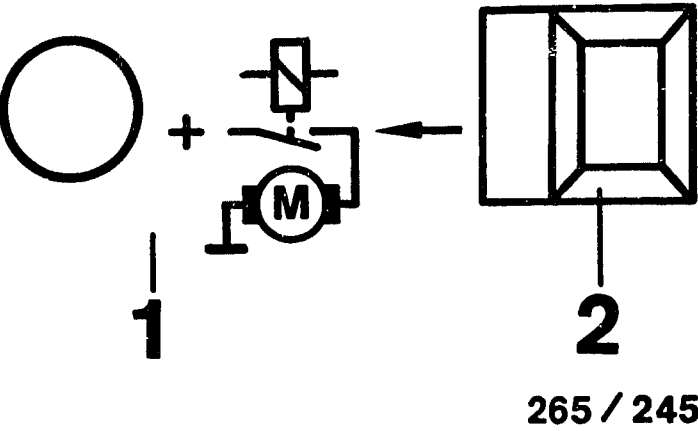
Under test (Measurement at the terminals)	Addition- al operation	Test specifi- cation (reading)	Possible causes of trouble
Alternator voltage from term. 61/D+ (term. 15)	Ignition on	LED 1 (top picture) lit.	* In some cases, LED does not go out until after burst of throttle (test is O.K. in this case).
	Start engine	LED 1 (top picture) goes out when engine running	* Test lead and signal from alternator term. 61 * Alternator defective.
Stop-lamp switch (term. 25)	Ignition on	LED 2 (top picture) lit	* Stop-lamp switch defective. * Check lead to stop-lamp switch.
	Press brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected to to stop-lamp switch.



RAPID DIAGNOSIS CHART (CONTINUED)

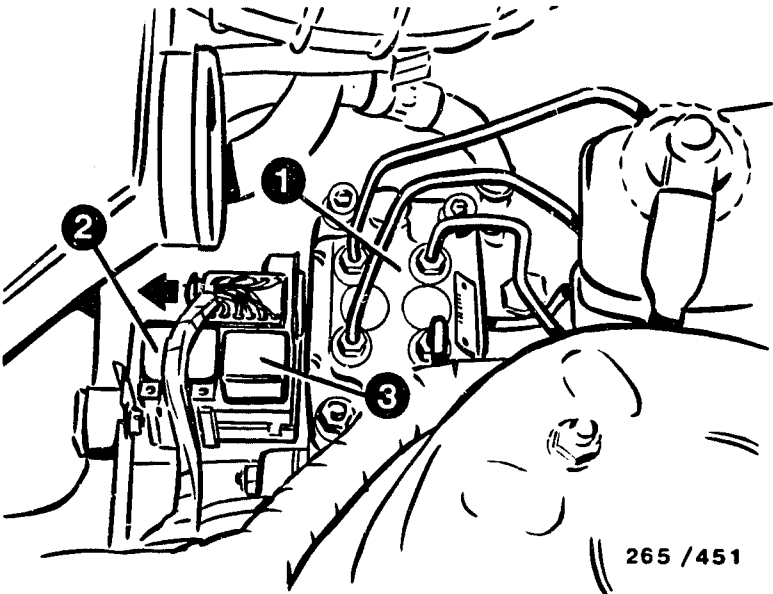
Program-selector-switch position 3

Under test (measurement at the terminals)	Additional operation	Test specifications (reading)	Possible causes of trouble
Motor relay, pump motor in hydraulic modulator (term.14 and term.28)	Ignition on, constantly press push- button 2 (upper ill- ustration)	LED 1 lights up, pump motor runs. After releasing push-button, LED stays lit due to run-on of motor (upper illustration).	<ul style="list-style-type: none">* Motor relay defective* Check frame connection and positive terminal of pump motor* Check following leads: from controller term. 14 and term. 28 to hydraulic modulator term. 9 or term. 12. Positive lead to hydraulic modulator term. 8.* Pump motor or hydraulic modulator defective.



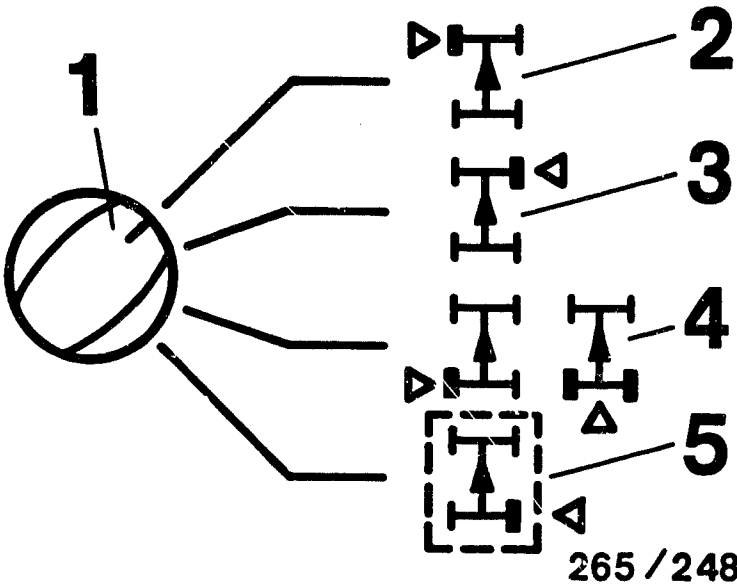
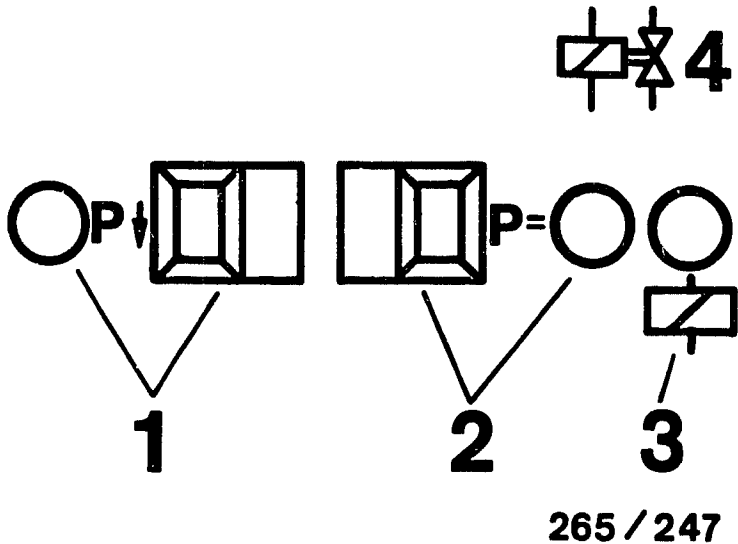
Program-selector-switch position 4 not applicable.

1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay



RAPID DIAGNOSIS CHART (CONTINUED)
 Program-selector-switch position 5 (4-channel hydraulic modulator)

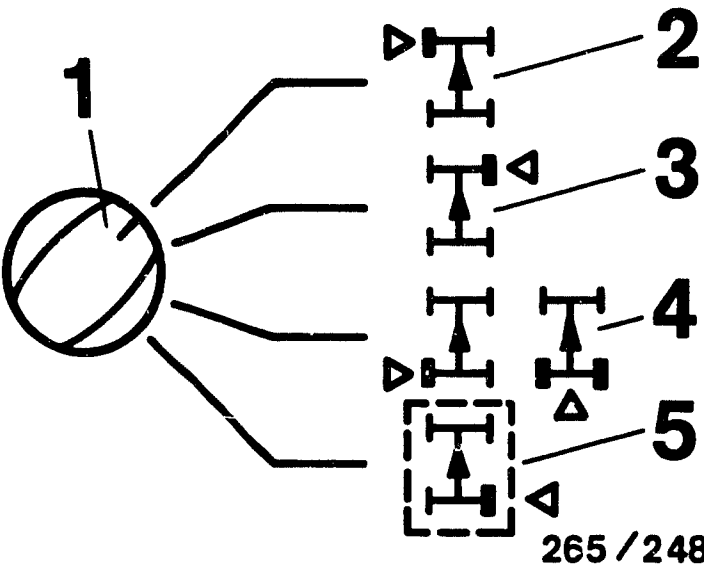
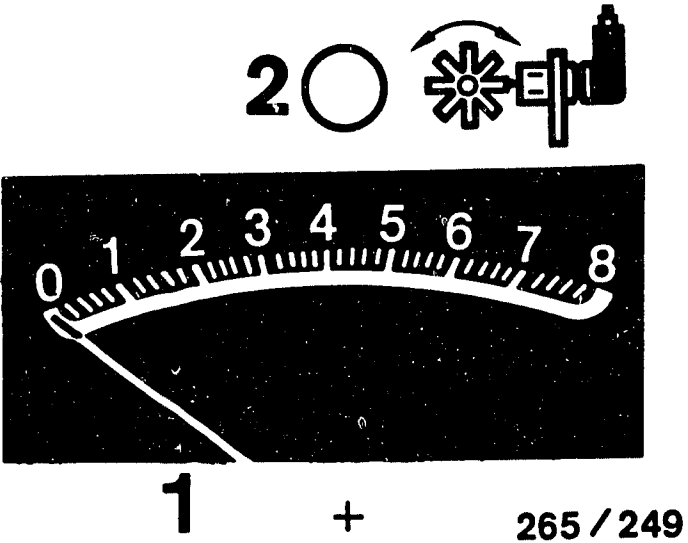
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Valve relay operation (term. 27)	Ignition on	LED 3 (upper illustration) lights up	*Valve relay (winding) or leads defective
Solenoid-operated valves in hydraulic modulator for operation and and mix-up. NOTE: Check each wheel separately in turn. Keep to operating sequence.	Chock up vehicle. Ignition on. The wheel being tested must be freely turnable by hand. Set switch 1 for wheel selection to wheel to be tested (center illustration).		* Repeat test with engine running * Valve relay (make contact) defective * Break in lead from valve relay term. 87 to B+ * Brake leads at hydraulic modulator mixed up
Operation, pressure holding	1. Constantly press push-but. P = (upper illustration)	LED P= (upper illustration) lights up)	* Current value not obtained (LED P arrow or P= goes out; upper illustration): battery insufficiently charged. Repeat check with engine running.
	2. Constantly press brake pedal	Wheel turnable by hand	
	3. Release push-button P = (upper illustration)	LED P= goes out (upper illustration) Wheel locks	
Operation, pressure reduction	4. Press push-button P arrow (upper illustration)	LED P arrow (upper illustration) lights up, wheel turnable by hand	* Solenoid-operated valves correctly connected electrically? Wheel, front left: term. 2 Wheel, front right: term. 35 Wheel, rear left: term. 18 Wheel, rear right: term. 19 Rear axle: term. - * Hydraulic modulator defective
	5. Release push-button P arrow (upper illustration)	LED P arrow (upper illustration) goes out, wheel locks	
	6. Release brake pedal		



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 6 (4 wheel-speed sensors)

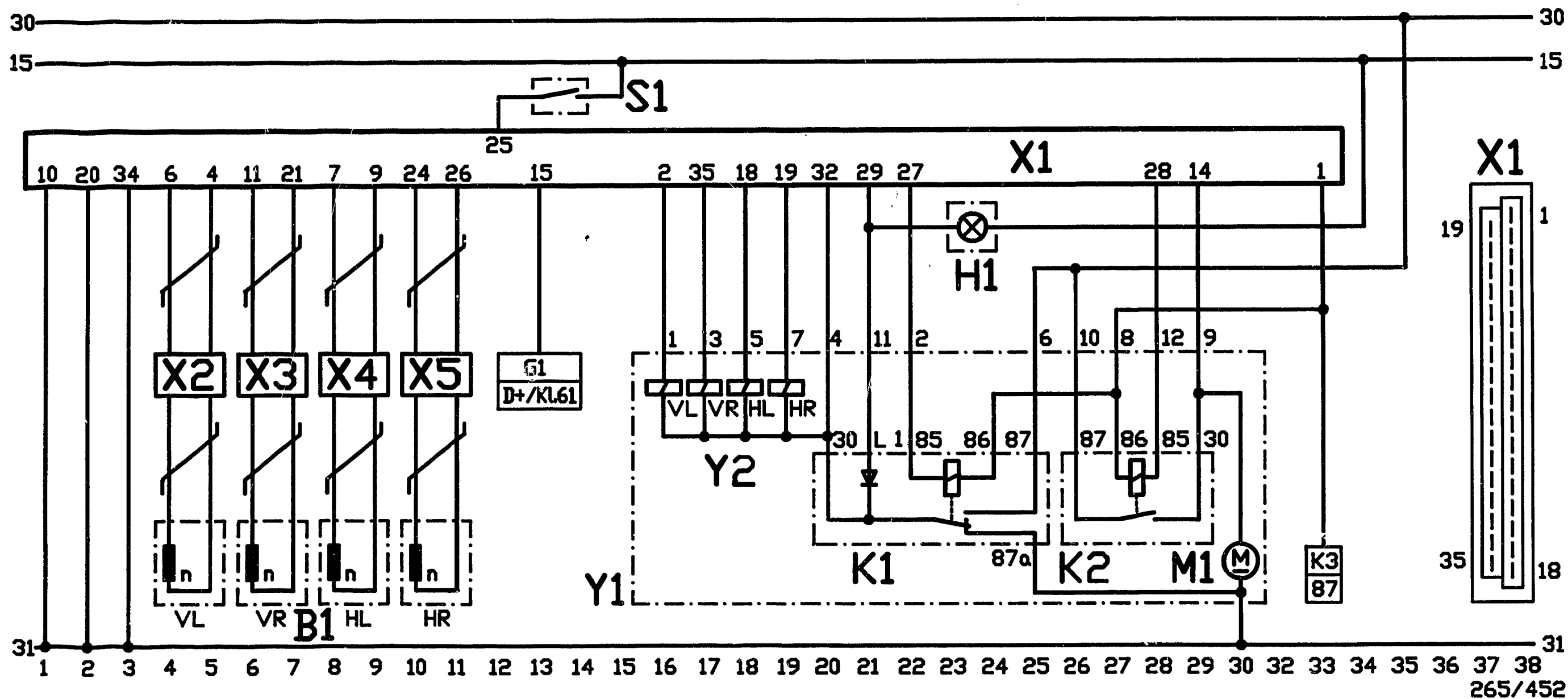
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
<p>Wheel-speed sensor for operation and mix-up</p> <p>NOTE: Check each wheel separately in turn.</p> <p>Wheel, front left: term.4 and t.6</p> <p>Wheel, front right: term.11 and term.21</p> <p>Wheel, rear left: term.7 and term.9</p> <p>Wheel, rear right: term.24 and term.26</p>	<p>Chock-up vehicle. Ignition on.</p> <p>The wheel being tested must be freely turn- able by hand.</p> <p>When testing the driven axle, the wheel not being tested must be locked.</p> <p>Set switch for wheel selection to wheel to be tested (lower illustration)</p> <p>Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (upper illustration)</p>	<p>1. Smallest reading larger 1,6 divisions</p> <p>2. Permissible fluctuation max. 25 % of largest reading.</p>	<p>*Wheel-speed-sensor lead mixed up</p> <p>*Brake in wheel-speed- sensor lead</p> <p>*Wheel-speed sensor defective</p> <p>Winding resistance Front axle: 0,6...1,6 k Ω</p> <p>Rear axle: 0,6...1,6 k Ω</p> <p>*Air gap between wheel- speed sensor and ring gear too wide</p> <p>*Ring gear defective (e.g. corroded, dirty) or loose.</p> <p>*Ring gear with incorrect number of teeth installed Front axle: 48 teeth Rear axle: 48 teeth</p> <p>*Wheel-bearing clearance too large</p> <p>*Instrument gives reading, LED 2 does not light up: loose contact in wheel- speed sensor lead.</p>



TEST SPECIFICATIONS

Wheel-speed sensor		
* Winding resistance at ambient temperature (-10°C...+120°C) for front wheels:	600...1600	Ω
rear wheels:	600...1600	Ω
Hydraulic-modulator solenoid valves		
* Winding resistance at ambient temperature (-10°C...+120°C):	0,7...1,7	Ω
Air gap between wheel-speed sensor and ring gear		
* at front wheels:	0,8 ±0,5	mm
* at rear wheels:	0,8 ±0,5	mm
Tightening torque for		
* fastening screws of wheel-speed sensors:	> 8	Nm
* Brake-line connections at hydraulic modulator:	12...16	Nm
Number of teeth on ring gears of wheel-speed sensors		
* at front wheels:	48	teeth
* at rear wheels:	48	teeth

For production reasons:
continued on the following
coordinate.



B1 = Wheel-speed sensor
 G1 = To alternator
 H1 = ABS warning lamp
 K1 = Valve relay
 K2 = Engine relay
 K3 = Motronic relay

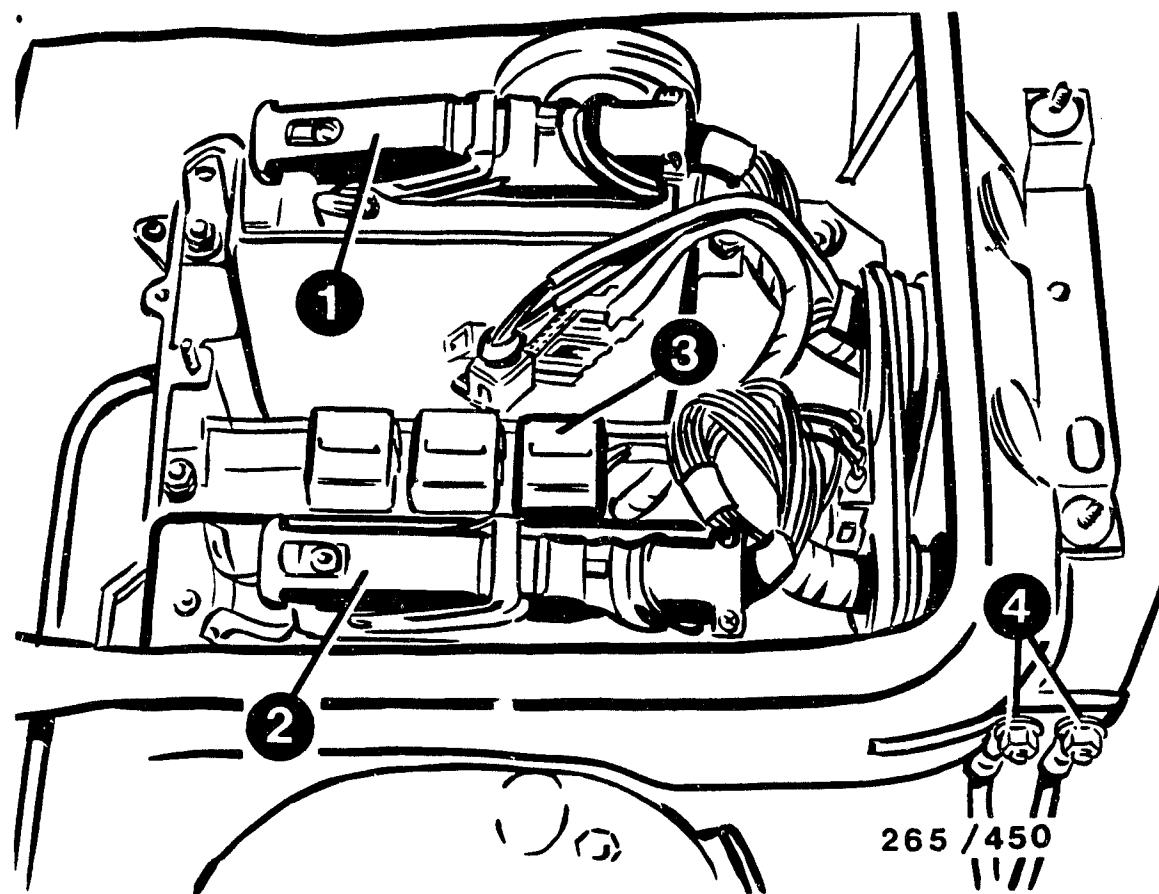
M1 = Return pump motor
 S1 = Brake-light switch
 X1 = Controller plug (35-pole)
 X2...X5 = Wheel-speed-sensor plug
 Y1 = Hydraulic modulator
 Y2 = Solenoid valves

HL = Rear left
 HR = Rear right
 VL = Front left
 VR = Front right

ELECTRICAL TERMINAL DIAGRAM (1.1988 ->)

C19 — ==>

C20 — <==

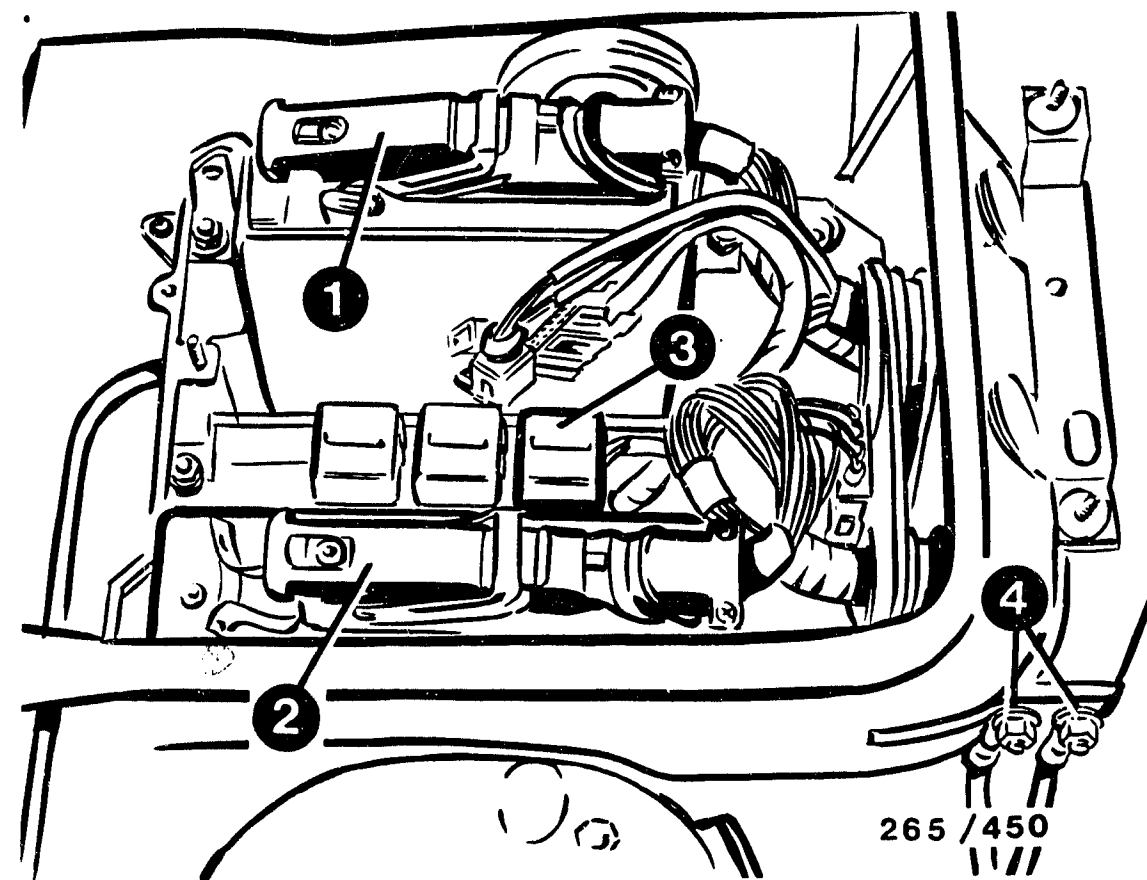


- 1 = Motronic control unit
- 2 = ABS controller
- 3 = Motronic relay
- 4 = Ground terminals

INSTALLATION POSITION OF COMPONENTS

The information given on installation locations is always referenced to the direction of travel.

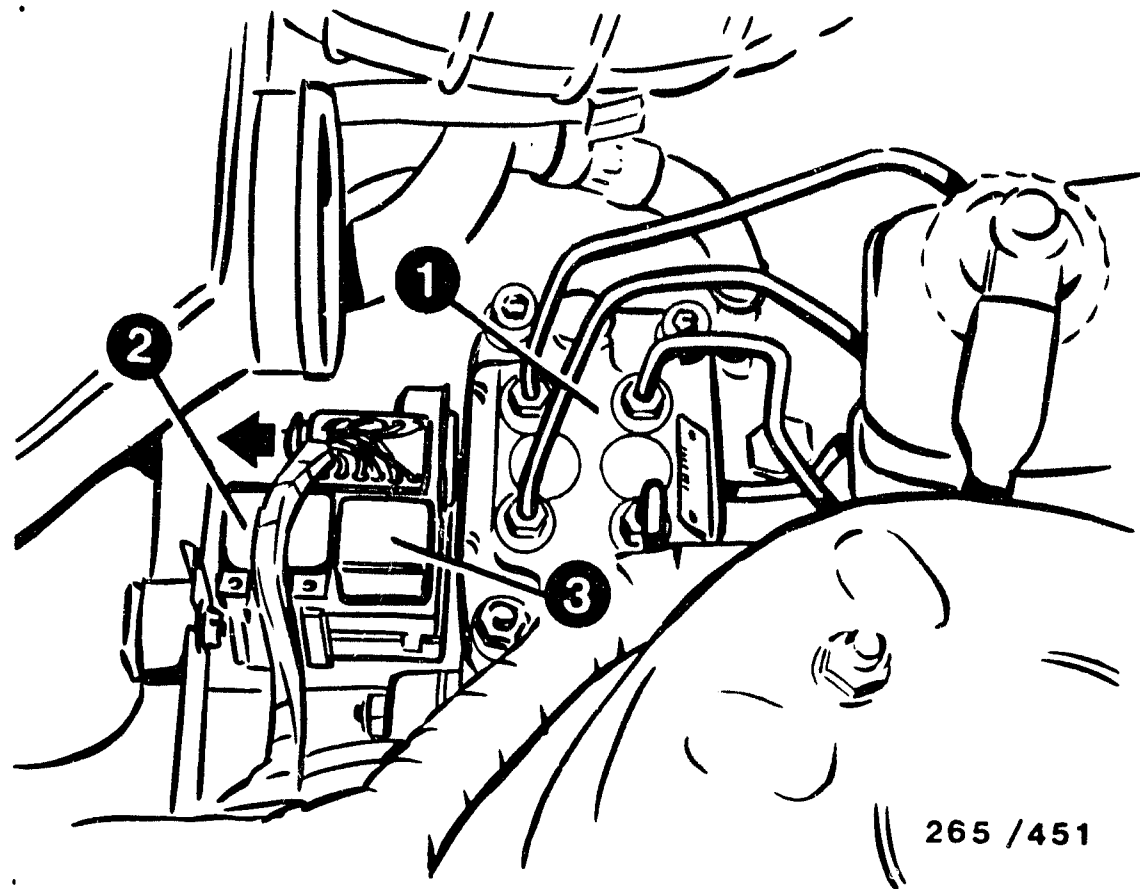
- * ABS controller:
In equipment compartment beneath hood, right.
Unscrew cover.
Detach plug:
Raise unlocking bracket/press back spring
and disconnect wiring-harness end of plug from
mechanical coding.
- * ABS warning lamp:
In instrument cluster.
Labelled: ABS.



- 1 = Motronic control unit
- 2 = ABS controller
- 3 = Motronic relay
- 4 = Ground terminals

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Over-voltage protection relay:
An over-voltage protection relay is no longer
fitted. The over-voltage protection is located
in the controller (Z-diode) and the supply of
power is assumed by the Motronic relay.
- * Ground terminal:
In engine compartment at control-unit box, left
beneath a cover.



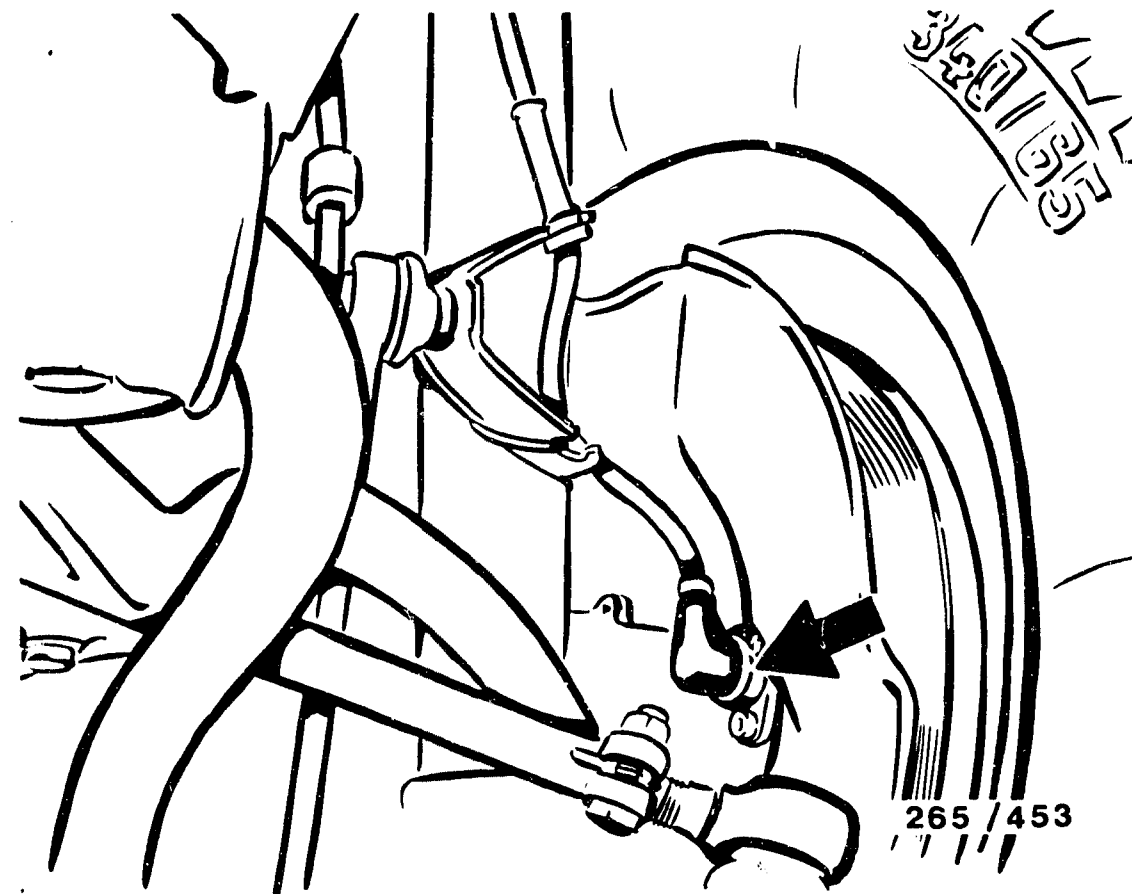
- 1 = Hydraulic modulator
- 2 = Engine relay
- 3 = Valve relay
- Arrow = Plug locking mechanism

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Hydraulic modulator:
In engine compartment, left ahead of brake master cylinder.

The hydraulic modulator is not to be repaired, but rather replaced as a complete assembly.
Exception: relay change.
To remove plug, detach plug locking mechanism in direction of arrow. To fit, press locking mechanism back again.

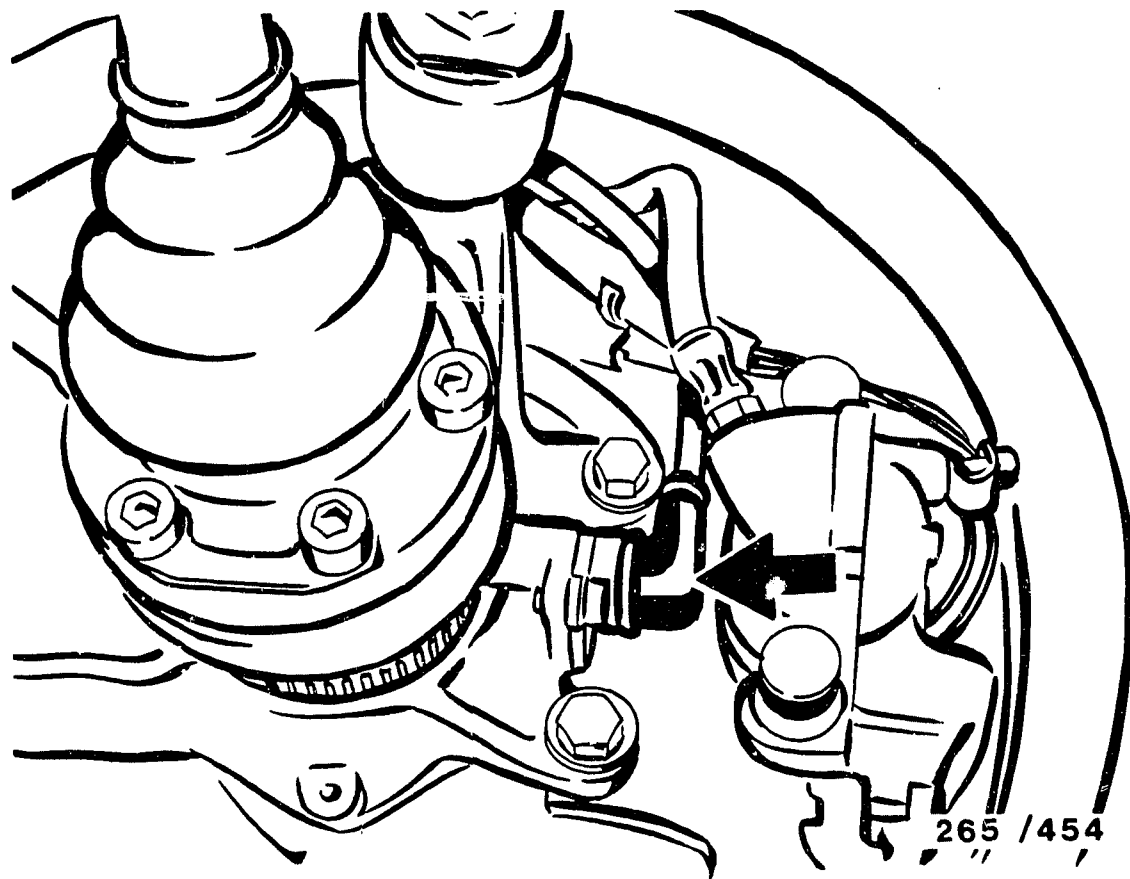
Pay attention to correct assignment of brake-line connections.



Arrow = Wheel-speed sensor, front

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Wheel-speed sensor, front axle:
One sensor each on the left and right in steering knuckles.
Wheel-speed-sensor plug connections:
In engine compartment on left and right at wheel arch, roughly in center.



Arrow = Wheel-speed sensor, rear

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Wheel-speed sensor, rear axle:
One sensor each on left and right in rear-axle link.
To replace, remove wheel and detach brake caliper.

Wheel-speed-sensor plug connections:

Beneath rear seat bench on left and right.
Important! Do not damage rubber sleeve in floor plate when pulling through plug connection.

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : FIA-5003
BOSCH system : LU2-Jetronic
Make of vehicle : FIAT / LANCIA
Basic microcard : PKW-064

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Rapid diagnosis chart.....	05
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Installation position of components.....	13

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle models:

FIAT Croma 2.0 i.e. Turbo cat.
LANCIA Thema 2.0 i.e. Turbo cat.
with 1.995 l / 4-cyl. engine DOHC 834
D/CH/A/S version 07.86->

- * LU2-Jetronic with 25-pole control unit:
0 280 000 351.
- * Engine-speed tripping by means of TD signals from term. 10 of ignition control unit (non-Bosch product)

5-pole air-flow sensor and 7-pole control relay.
- * Solenoid-operated injection valves with brass wire coil.
- * Start control
- * Delayed overrun cutoff by means of LU-control unit.
- * Lambda closed-loop control with heated sensor.
- * 3-stage full-load relay (Bitron, non-Bosch product).
Activated by full-load signal of control unit, term. 6 and by engine-speed pulses from term. 1 of ignition coil.
- * Exhaust turbo-supercharger and 3-way exhaust catalytic converter
- * For testing fuel pressure, connect pressure gauge with connection piece KDJE-P 100/14 at fuel-distributor supply line.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 123

Test step	Switch		Termi- nals	Testing of component/function	Test instructions/ Test conditions	Set values
	V	Ω				
1	5	—	1 — 5	TD pulses from ignition control unit	Shift into neutral, start engine	TD pulses on oscilloscope
2	6	—	9 — 5 (+) (—)	Voltage from control relay term. 87	Shift into neutral, start engine	8...15 V
3	7	—	4 — 5 (+) (—)	Voltage from ignition and starting switch term. 15	Shift into neutral, start engine	8...15 V
4	 V	11	8 — 5	Resistor set in air-flow sensor	—	100...200 Ω
5	 V	12	7 — 5	Resistance of potentiometer in air-flow sensor	Deflect air-flow sensor flap as far as it will go	60...1000 Ω
6	 V	13	10 — 5	Resistance, temperature sensor (engine)	+15...+30°C: Approx. +80°C:	1,45...3,3 k Ω 280...360 Ω
7	 V	14	13 — 5	Frame connection of output stage		0...10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (continued)

Adapter lead: 1 684 463 123

Test step	Switch	Ω	Termin-als	Testing of component/function	Test instructions/ test conditions	Set values
8	 V	16	2 - 9	Resistance of idle contact	Accelerator at rest : Accelerator depressed somewhat:	0...10 Ω Infinity Ω
9	 V	17	3 - 9	Resistance of full-load contact in throttle-valve switch, term. 3 with resistance of 3-stage full-load relay	Accelerator at rest : Accelerator completely depressed:	Infinity Ω 10...15k Ω
10	 V	18	12 - 9	Resistance of solenoid-operated injection valves connected in parallel	+15...+30°C : approx. +80°C :	6,8...9,5 Ω 7,0...10,0 Ω

REMARK: The following components with respective connecting leads are not covered by the universal test adapter for these tests:

1. Auxiliary-air device: positive lead from term. 87 of control relay, negative lead to engine ground.
2. Electric fuel pump: positive lead from term. 87b of control relay (via pump fuse), negative lead to vehicle ground.
3. Sensor heater: positive lead from term. 87b of control relay (via sensor fuse), negative lead to engine ground.
4. Lambda sensor: sensor lead to control unit term. 20 (shielding to term. 5), sensor housing to vehicle ground.

TEST SPECIFICATIONS

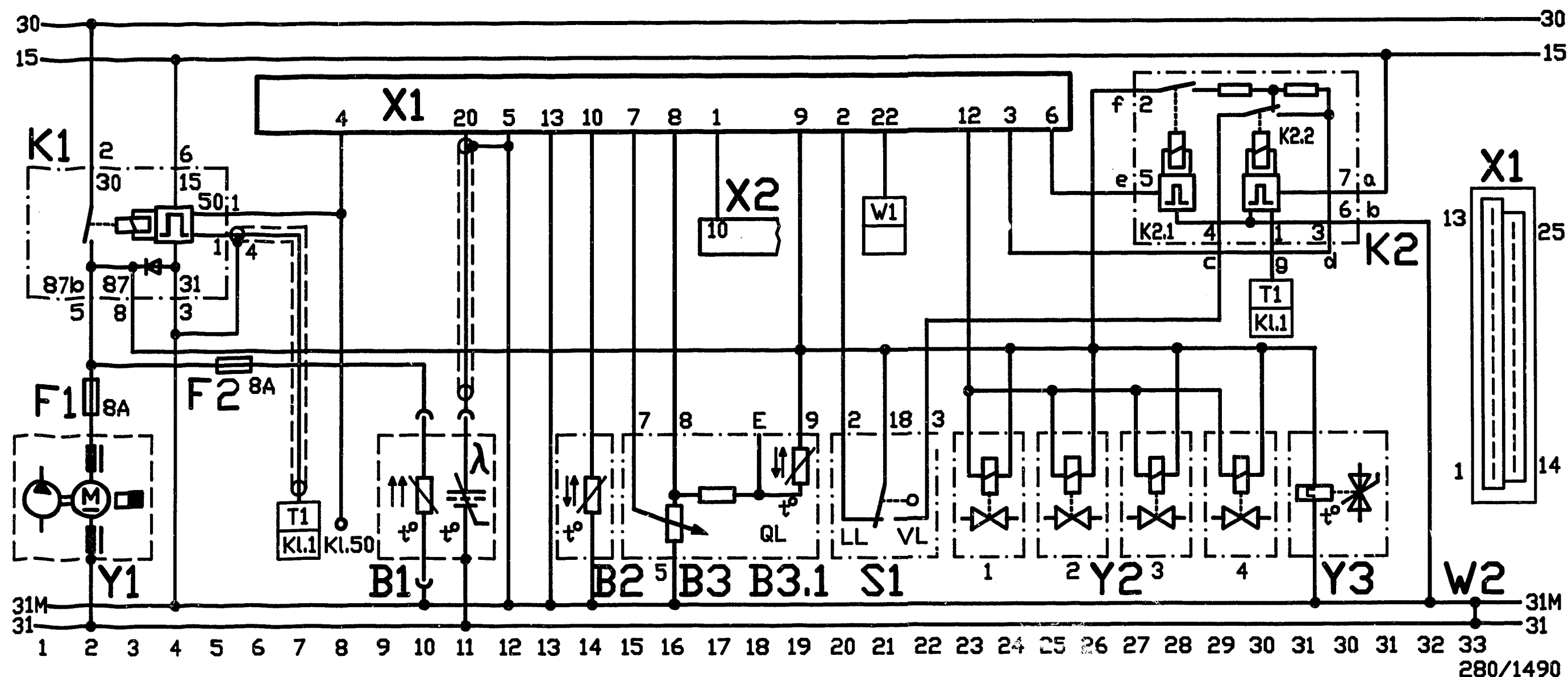
Component/function	Set values
Electric fuel pump	
* Fuel delivery and return:	at least 800 cm ³ /30 s
* Supply voltage under load:	at least 12 V
Pressure regulator	
* Fuel pressure with engine at standstill: at idle:	2,8...3,2 bar approx. 0.5 bar lower
Fuel system, leakages	
* Fuel pressure after 20 mins. with engine at standstill:	at least 1.0 bar
Auxiliary-air device	
* Resistance value	35...70 Ω
Air-flow sensor	
* Resistance value between	
term. 8 and term. 5:	340 ... 450 Ω
term. 7 and term. 5:	60 ...1000 Ω 1)
term. 9 and term. 5:	500 ... 760 Ω
term. 8 and term. 9:	160 ... 300 Ω
1) (Fully deflect air-flow sensor flap)	
Temperature sensor (engine)	
* Internal electrical resistance at ambient temperature +15...+30°C:	1,45...3,3 k Ω
With engine at warm. op. temp. approx. +80°C :	280...360 Ω
Lambda-sensor heater	
* Internal electrical resistance (PTC) with engine at standstill:	1...15 Ω

TEST SPECIFICATIONS (Continued)

Component/Function	Set values
Solenoid-operated injection valve	
* Internal electrical resistance at ambient temperature +15...+30°C:	14,5...17,5 Ω
* Leakage after 60s:	no drop must fall
Start control	
* Voltage at injection valve on initiation of starting: after approx. 15s:	greater than 1.5 V approx. 0.5 V
Idle adjustment	
Engine at normal op. temp., approx. +80°C	
* Idle speed:	800...900 min ⁻¹
CO adjustment	Integrator voltage
Engine at norm. op. temp., approx. +80°C	Engine at norm. op. temp., (test pin term. 22)
* Open-loop control (pull apart plug-in connection of sensor lead):	fixed voltage value between 5 ... 9 V
* Closed-loop control (connect up plug-in connection):	indicator fluctuates between 2 voltage values
* Adjustment:	mean value with closed-loop control same as with open-loop control

* Rich value (pull apart plug-in connection and apply control-unit lead to ground):	10...13 V
* Lean value (apply 2V to control-unit lead):	less than approx. 1.0 V

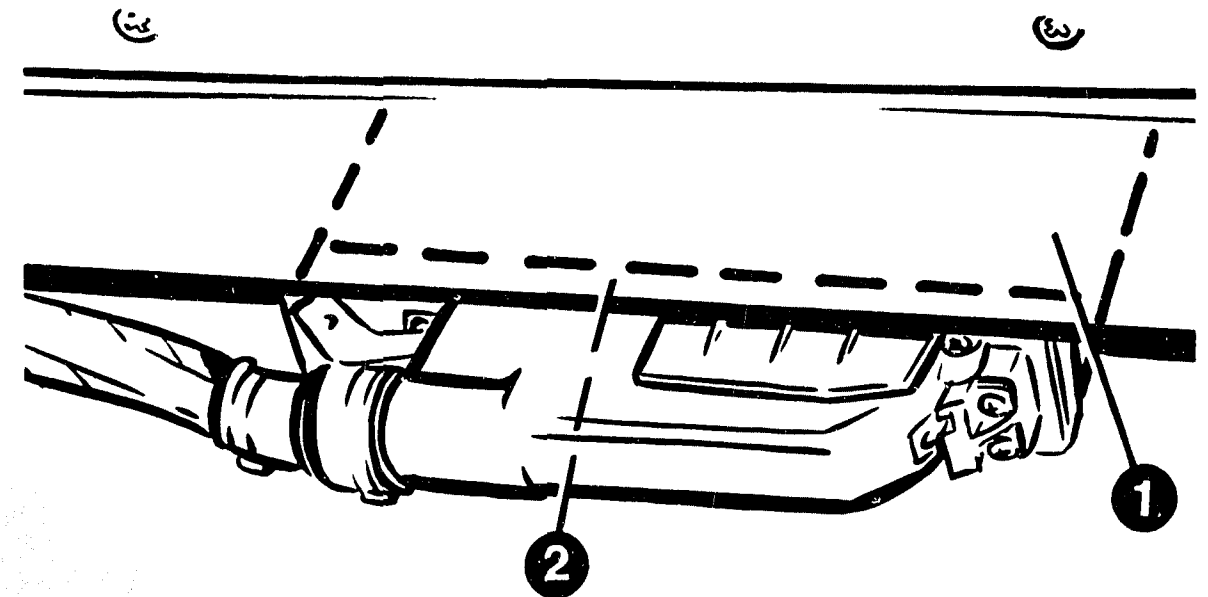
See equipment and Autodata microcards for the setting values for ignition, valve clearance and other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

- | | | |
|---------------------------------------|----------------------------------|---|
| B1 = Lambda sensor (heated) | K2 = 3-stage full-load relay | W2 = Ground strap, engine |
| B2 = Temperature sensor (engine) | K2.1= Load relay | X1 = Control-unit plug |
| B3 = Air-flow sensor | K2.2= Engine-speed relay | X2 = Ignition-control-unit plug |
| B3.1= Temperature sensor (intake air) | S1 = Throttle-valve switch | Y1 = Electric fuel pump |
| F1 = Fuse (fuel pump) | T1 = Ignition coil | Y2 = Solenoid-operated injection valves |
| F2 = Fuse (sensor heating) | W1 = Test pin/integrator voltage | Y3 = Auxiliary-air device |
| K1 = Control relay | | |

Re K2: 1st stage with c p load signal from term. 6 (without throttle-valve-switch signal).
 2nd stage only throttle-valve switch closed.
 3rd stage throttle-valve switch closed and engine-speed signal.



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For production reasons:
continued on the following
coordinate.

- 1 = Control unit of ABS system
- 2 = To control unit of LU-Jetronic

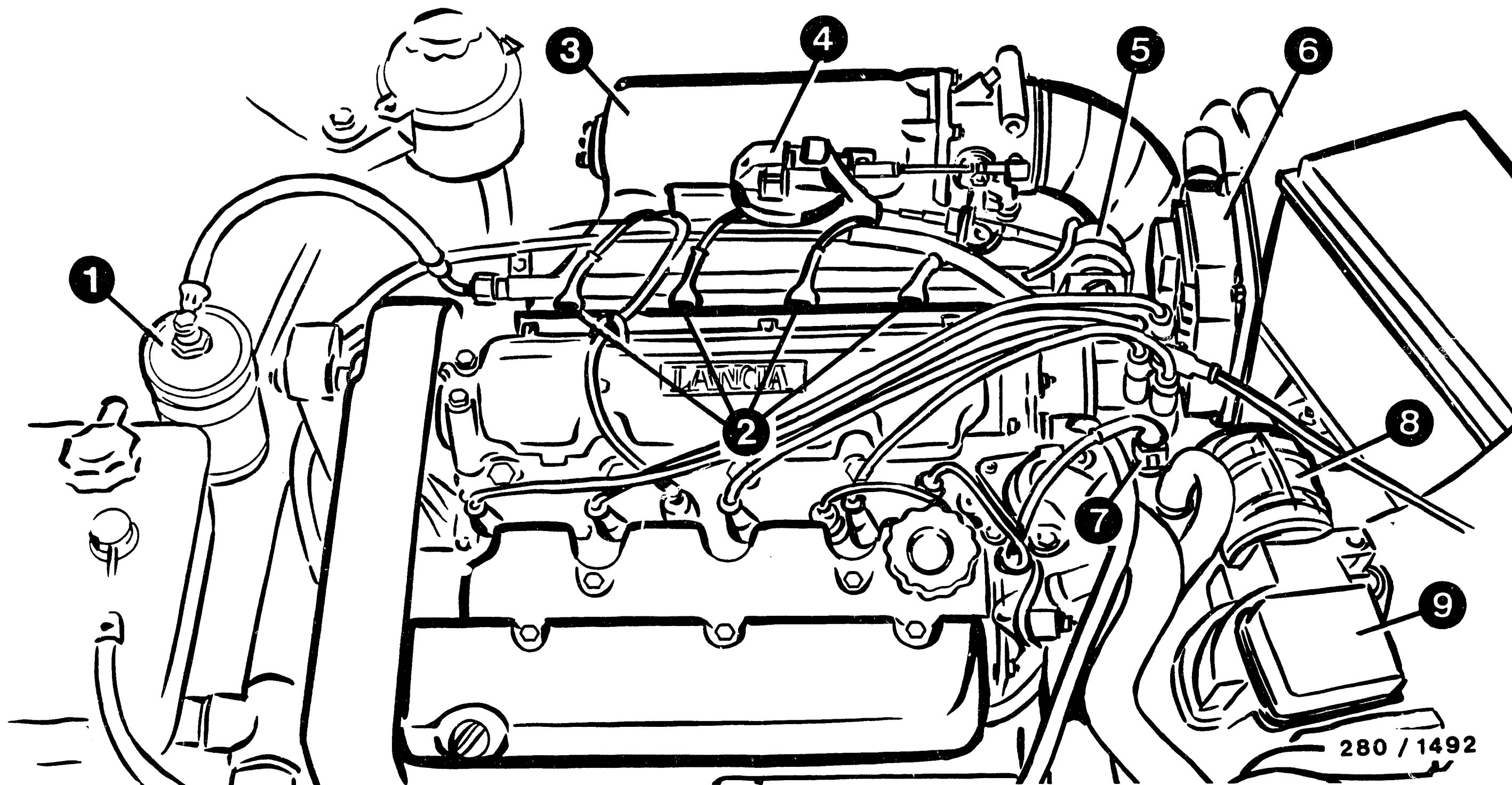
INSTALLATION POSITION OF COMPONENTS

The information regarding installation location is always referenced to the direction of travel.

* LU-Jetronic control unit in passenger compartment.

Both control units become accessible following removal of the cover below the glove compartment. Note: LU-control unit is located above ABS control unit.

For electrical testing with universal test adapter, press up locking mechanism (locking lug) and pull off control-unit plug. Connect 25-pole adapter lead to periphery.



1 = Fuel filter
2 = Solenoid-operated
injection valves

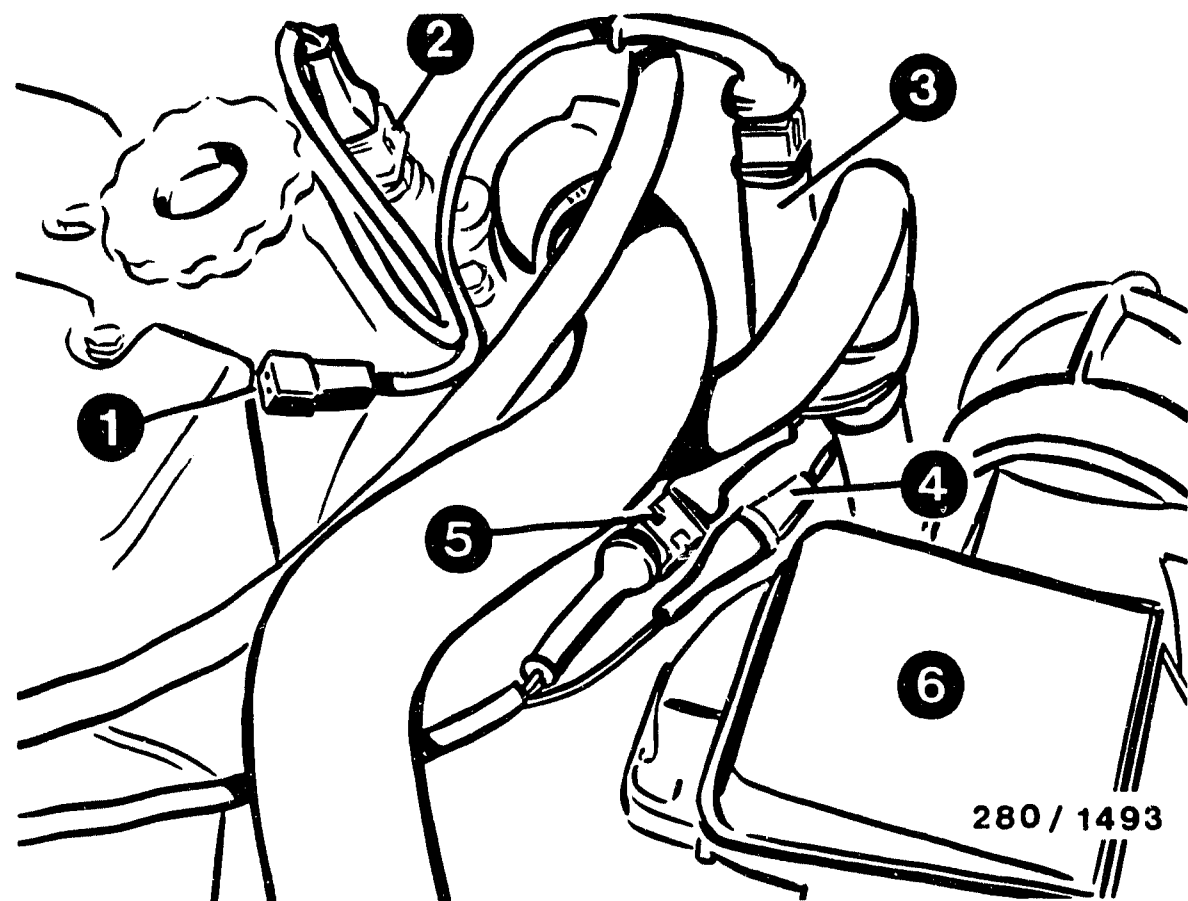
3 = Intake manifold
4 = Throttle-valve switch
5 = Pressure regulator

6 = Ignition control unit
(non-Bosch product)
7 = Auxiliary-air device

8 = Air guide
9 = Air-flow
sensor

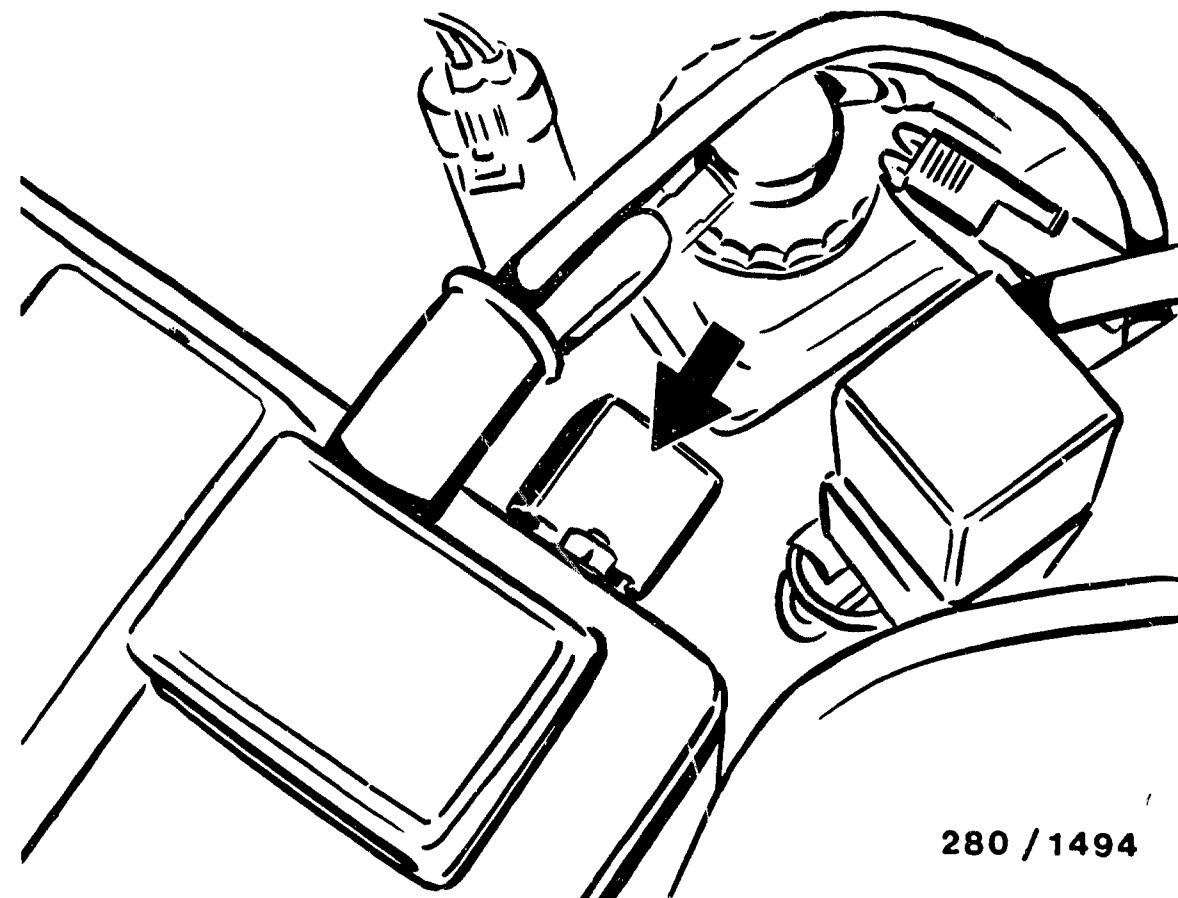
INSTALLATION POSITION OF COMPONENTS (continued)

* Arrangement of components on engine



- 1 = Test pin, term. 22, control unit;
integrator voltage of lambda closed-loop control.
- 2 = Temperature sensor (engine)
- 3 = Auxiliary-air device
- 4 = Plug connection for lambda sensor signal
- 5 = Plug connection for sensor heating
- 6 = Air-flow sensor

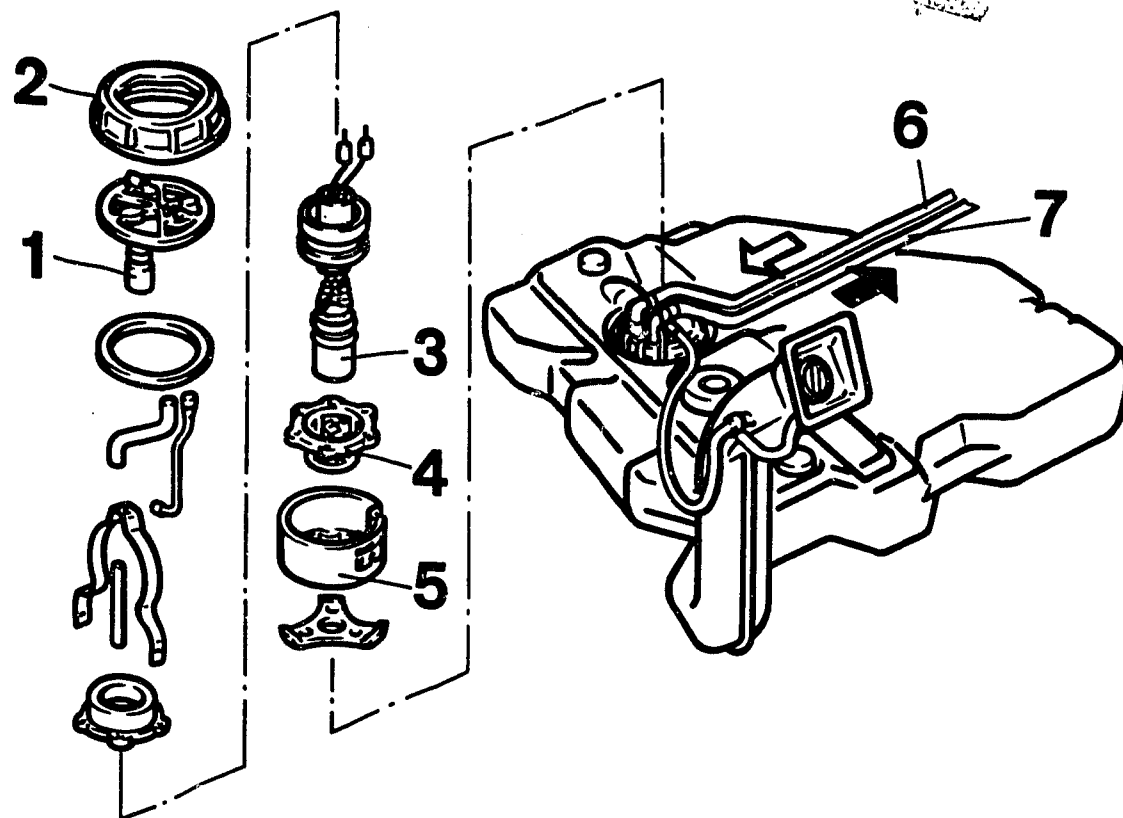
INSTALLATION POSITION OF COMPONENTS (continued)



Arrow = Control relay, attached to rear battery holder.

INSTALLATION POSITION OF COMPONENTS (continued)

- * Lambda sensor:
In exhaust manifold ahead of catalytic converter;
at engine, front.
- * 3-stage full-load relay (Bitron, non-Bosch product):
At front, beneath coolant expansion tank.



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- 1 = Valve
- 2 = Closure ring
- 3 = In-tank electric fuel pump
- 4 = Fuel strainer
- 5 = Retaining ring
- 6 = Return line
- 7 = Fuel-injection tubing, supply

For production reasons:
continued on the following
coordinate.

INSTALLATION POSITION OF COMPONENTS (continued)

* Fuel-supply components

TABLE OF CONTENTS

Trouble-shooting instructions : OPE-5012

BOSCH system : Headlight vertical-aim control

Make of vehicle : OPEL

Basic microcard : AUD-515

Section	Coordinate
Special features, safety, usage	02
Trouble-shooting chart	04
Rapid diagnosis chart for headlight aiming device	05
Test specifications	13
Electrical terminal diagram	14
Installation position of components	15

SPECIAL FEATURES

- * This microcard, valid at the time of publication, contains trouble-shooting instructions for headlight vertical-aim control (LWR) on the following OPEL models:
OMEGA A (09.86 ->)
SENATOR B (09.86 ->)
- * The system is similar to headlight vertical-aim control Audi 100/200
- * Adaptation of the LWR system to the various vehicle versions is effected by way of the manual adjusters.
The manual adjusters are marked with labels.

Label "DA":
Omega Lim. (LS and GL versions) and Senator B

Label "DB":
Omega Lim. and Senator B (CD, GT and SR versions)

Label "DC":
Omega Caravan (LS and GL versions)

Label "DD":
Omega Caravan (GT and SR versions)

Label "DE":
Omega 3000

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart leads to various causes/component faults.
A detailed description of trouble-shooting is given in the trouble-shooting chart in the basic instructions.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to information given in basic instructions so as to avoid endangering people and in order to prevent damage to engine, trigger boxes, control units or ignition system.

IMPORTANT!
Heavy duty ignition system with hazardous high and low voltage!

Coming into contact with components or terminals which carry voltage may be fatal (on both primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Headlight setting too high
or too low.
2. Headlight cannot be adjusted
using LWR system.
3. Cutoff flickers when
driving.

Cause (component fault)		
*		Check headlight basic setting
*	*	Mechanical defect in headlight
*		Check fuse, term. 56b
*		Control motor with actuator defective
*		Vertical-aim leveler defective
*		Short circuit or open-circuit in wiring harness
	*	Control-motor mount defective

RAPID DIAGNOSIS CHART FOR TESTING WITH HEADLIGHT AIMING DEVICE 0 681 130 .. OR 0 684 100 ..
Perform tests on both headlights in each case!

Diagnosis chart for models Omega Lim. (LS- and GL- versions)

Test step	Set adjuster on the motor vehicle to:	Set headlight aiming device to:	Set headlight to:	Indication on headlight aiming device
1	Position "0" (basic setting)	10 cm inclination	Cutoff	—
2	Position "3"	Cutoff	—	Adjustment to min. - 33 cm
3	Position "0" (basic setting)	10 cm inclination	—	Between -15 cm and -5 cm Setting is obtained again after a brief test drive (hysteresis tolerance)

Diagnosis chart for models Omega Lim. (CD-, GT- and SR- versions)

Test step	Set adjuster on the motor vehicle to:	Set headlight aiming device to:	Set headlight to:	Indication on headlight aiming device
1	Position "0" (basic setting)	10 cm inclination	Cutoff	—
2	Position "3"	Cutoff	—	Adjustment to min. -29 cm
3	Position "0" (basic setting)	10 cm inclination	—	Between -15 cm and -5 cm Setting is obtained again after a brief test drive (hysteresis tolerance)

RAPID DIAGNOSIS CHART FOR TESTING WITH HEADLIGHT AIMING DEVICE 0 681 130 .. OR 0 684 100 ..
Perform tests on both headlights in each case!

Diagnosis chart for models Omega Caravan (LS- and GL- versions)

Test step	Set adjuster on the motor vehicle to:	Set headlight aiming device to:	Set headlight to:	Indication on headlight aiming device
1	Position "0" (basic setting)	10 cm inclination	Cutoff	—
2	Position "3"	Cutoff	—	Adjustment to min. -35 cm
3	Position "0" (basic setting)	10 cm inclination	—	Between -15 cm and -5 cm Setting is obtained again after a brief test drive (hysteresis tolerance)

Diagnosis chart for models Omega Caravan (GT- and SR- versions)

Test step	Set adjuster on the motor vehicle to:	Set headlight aiming device to:	Set headlight to:	Indication on headlight aiming device
1	Position "0" (basic setting)	10 cm inclination	Cutoff	—
2	Position "3"	Cutoff	—	Adjustment to min. -31 cm
3	Position "0" (basic setting)	10 cm inclination	—	Between -15 cm and -5 cm Setting is obtained again after a brief test drive (hysteresis tolerance)

RAPID DIAGNOSIS CHART FOR TESTING WITH HEADLIGHT AIMING DEVICE 0 681 130 .. OR 0 684 100 ..
Perform tests on both headlights in each case!

Diagnosis chart for model Omega 3000

Test step	Set adjuster on the motor vehicle to:	Set headlight aiming device to:	Set headlight to:	Indication on headlight aiming device
1	Position "0" (basic setting)	10 cm inclination	Cutoff	—
2	Position "3"	Cutoff	—	Adjustment to min. -25 cm
3	Position "0" (basic setting)	10 cm inclination	—	Between -15 cm and -5 cm Setting is obtained again after a brief test drive (hysteresis tolerance)

RAPID DIAGNOSIS CHART FOR TESTING WITH HEADLIGHT AIMING DEVICE 0 681 130 .. OR 0 684 100 ..
Perform tests on both headlights in each case!

Diagnosis chart for model Senator B

Test step	Set adjuster on the motor vehicle to:	Set headlight aiming device to:	Set headlight to:	Indication on headlight aiming device
1	Position "0" (basic setting)	10 cm inclination	Cutoff	—
2	Position "3"	Cutoff	—	Adjustment to min. -34 cm
3	Position "0" (basic setting)	10 cm inclination	—	Between -15 cm and -5 cm Setting is obtained again after a brief test drive (hysteresis tolerance)

Diagnosis chart for models Senator B (CD-, GT- and SR- versions)

Test step	Set adjuster on the motor vehicle to:	Set headlight aiming device to:	Set headlight to:	Indication on headlight aiming device
1	Position "0" (basic setting)	10 cm inclination	Cutoff	—
2	Position "3"	Cutoff	—	Adjustment to min. -31 cm
3	Position "0" (basic setting)	10 cm inclination	—	Between -15 cm and -5 cm Setting is obtained again after a brief test drive (hysteresis tolerance)

TEST SPECIFICATIONS

Vertical-aim leveler (manual adjuster):

Potentiometer total resistance
(term. 3 with respect to term. 6): approx. 0,9...1,1 k Ω

Resistance in basic setting "0"
(term. 6 with respect to term. 7): approx. 370...580 Ω

Difference in resistance between
setting "0" and setting "3"
(term. 6 with respect to term. 7):

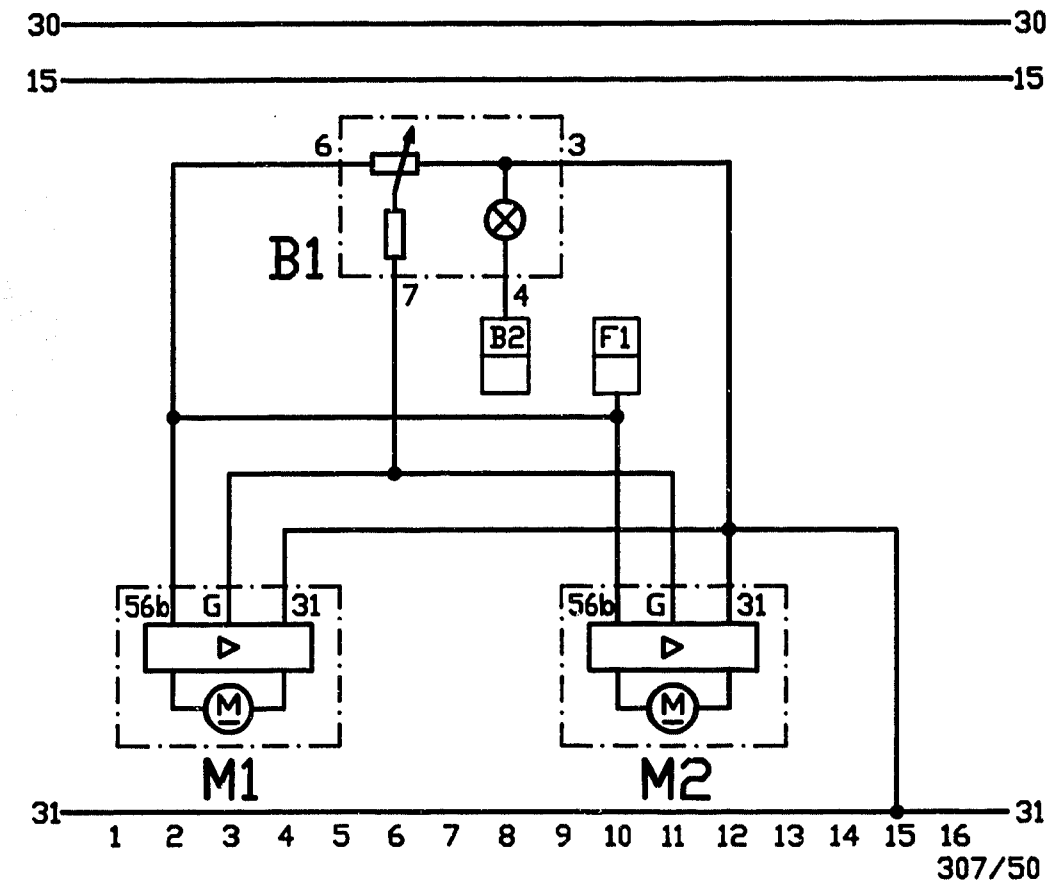
- Manual adjuster "DA": min. 370 Ω
- Manual adjuster "DB": min. 320 Ω
- Manual adjuster "DC": min. 390 Ω
- Manual adjuster "DD": min. 350 Ω
- Manual adjuster "DE": min. 270 Ω

Resistance must constantly change
between setting "0" and setting "3".

Control-motor travel between setting "0"
and setting "3" of manual adjuster:

- Manual adjuster "DA": min. 2,7 mm
- Manual adjuster "DB": min. 2,3 mm
- Manual adjuster "DC": min. 2,9 mm
- Manual adjuster "DD": min. 2,5 mm
- Manual adjuster "DE": min. 1,8 mm

Headlight basic setting: H -10 cm



B1 = Vertical-aim leveler with adjuster

B2 = to brightness control for instrument
illumination

F1 = to fuse, term. 56B

M1 = Control motor with actuator, left

M2 = Control motor with actuator, right

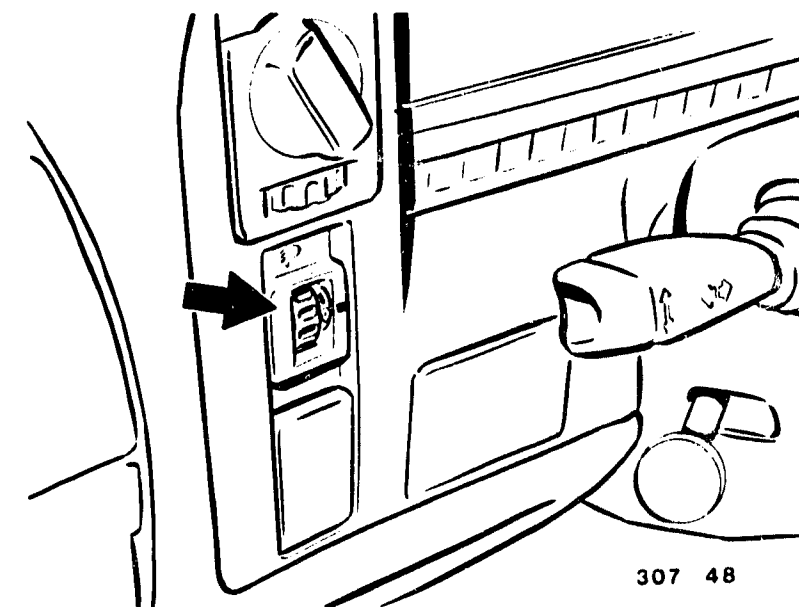
ELECTRICAL TERMINAL DIAGRAM - HEADLIGHT
VERTICAL-AIM CONTROL

INSTALLATION POSITION OF COMPONENTS

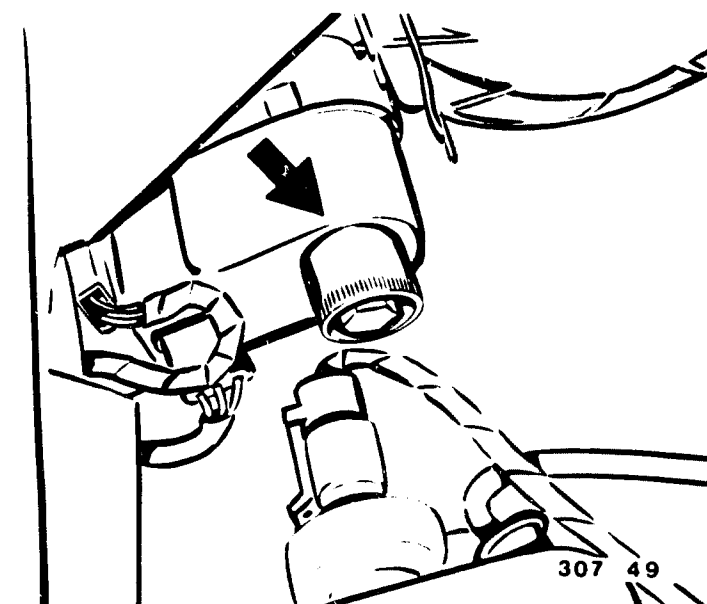
The vertical-aim leveler is located in the instrument panel (top picture, arrow).

The control motors with actuators (bottom picture, arrow) are attached to the headlamp housing by means of a bayonet socket.

The adjustment stems are connected to the reflectors by means of clamping elements.



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Trouble-shooting instructions : REN-5003
BOSCH system : ABS
Make of vehicle : RENAULT
Basic microcard : REN-507

TABLE OF CONTENTS

Section	Coordinates
Special features	02
Structure, usage	02
Safety and precautionary measures	02
Test requirements	03
Rapid diagnosis chart	05
Test specifications	19
Electrical terminal diagram	21
Installation position of components, notes on removal and installation	23

SPECIAL FEATURES

This microcard, valid at the time of publication, contains trouble-shooting instructions for the following models:

Renault Alpine 12.86 ->

- * ABS with 4 wheel-speed sensors and 3 hydraulic channels.
- * Number of teeth on sensor ring gears:
41 teeth at front wheels,
44 teeth at rear wheels.
- * Lateral acceleration sensor (a q)

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

- * For safety reasons, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.
Exception: relays.
- * Do not loosen any screws on the hydraulic modulator!
Danger of fatal accident due to brake failure.
- * Caution when handling brake fluid.
Poisonous!

For further information, see basic instructions.

TEST REQUIREMENTS FOR TESTING WITH ABS2 LED TESTER

- * Regulatory tire size fitted?
- * Check for firm seating of ground of return-supply pump.
- * Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.
- * Check for firm seating of ground strap between engine block and vehicle frame.
- * Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).
- * If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).
- * If the ABS warning lamp lights up constantly and does not go out, check the following points:
 - Controller plug sitting correctly on controller and latched?
 - All plug contacts O.K.?
 - Spring contacts latched?
 - Check installation position for correct seating of seal ring in controller plug, rounded side downward.

- Check wheel-speed-sensor leads for correct assignment at controller plug:

Wheel-speed sensors:

front left to term. 6 and term. 4.
front right to term. 11 and term. 21.
rear left to term. 8 and term. 9.
rear right to term. 24 and term. 26.
rear axle to term. — and term. —.

- V-belt snapped?
(Alternator provides no voltage, charge-indicator lamp and ABS warning lamp light up).
- * Connect ABS 2 LED tester to ABS wiring harness.
- Disconnect and connect controller only with ignition switched off.
- For testing, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).
- Observe LED (green) for current supply in all program-selector-switch positions.

C A U T I O N !

Do not drive with tester connected!

The brake system must be bled of air before the ABS test. Do not activate the ABS tester while the system is being bled.

Repeat the complete test program after any repairs are carried out.

The Antiskid System is a vehicle safety system.

Work on the system demands detailed knowledge of the system.

The conventional brake system must be O.K.

General information for trouble-shooting:

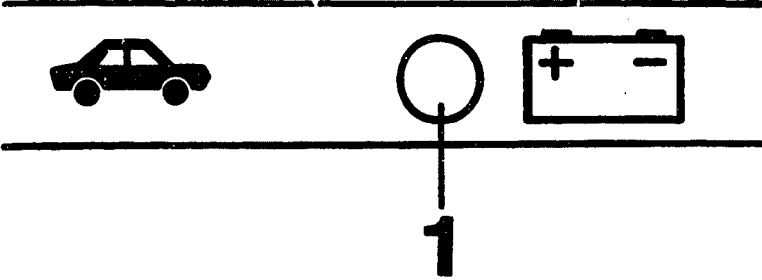
Check all leads for short circuit to ground and contact with positive leads and watch out for worn cable insulation and pinched leads.

RAPID DIAGNOSIS CHART

Do not drive with tester connected. Are all test conditions met?

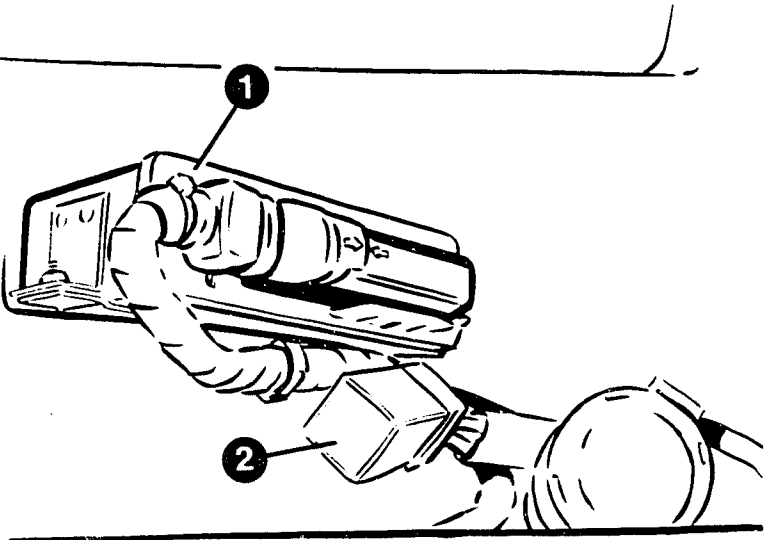
Program-switch positions 1 to 6

Testing of (measurement at terminals)	Additional operation	Test specifi- cation (reading)	Possible causes of faults
Power supply (term.1 und term.20)	Ignition on	LED 1 (top picture) continuously lit	<ul style="list-style-type: none">*Battery insufficiently charged*High voltage drops*Overvoltage-protection relay defective*Check lead to ignition and starting switch, term. 15



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1 = ABS controller
2 = Over-voltage protection relay

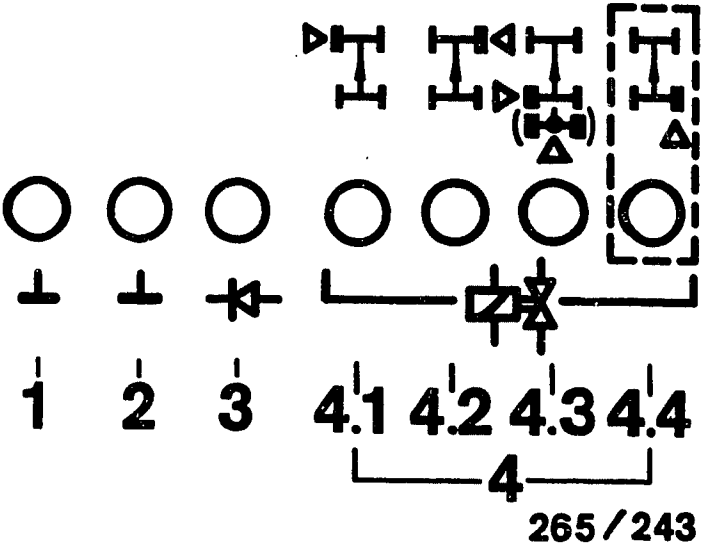


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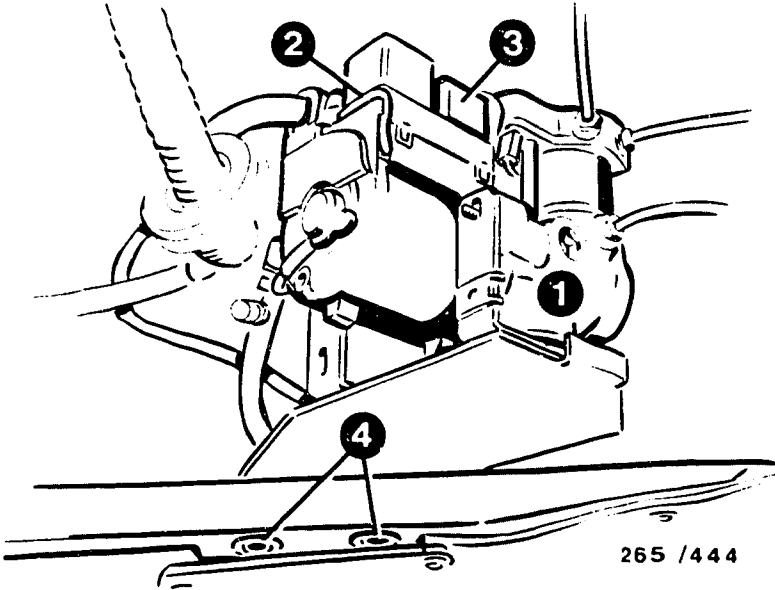
RAPID DIAGNOSIS CHART (CONTINUED)

Program-switch position 1 (3-channel hydraulic modulator)

Testing of (measurement at terminals)	Addition- al operation	Test specifi- cation (reading)	Possible causes of faults
Ground connection (term.10, term.34) Diode for warning lamp (term.29, term.32) Solenoid-operated valve internal res. (term.2, term.18, term.-, term.35) Off-position and ground connection of relay ABS warning lamp	Ignition on	6 LED (1 to 4.3) simultaneously brightly lit (top picture) ABS warning lamp in vehicle must light up	<ul style="list-style-type: none">* LED 1 and/or 2 (top picture) not lit: Check ground terminals for open circuit.* LED 3 (top picture) not lit: Diode defective, check ground connection of valve relay.* One or more LEDs 4 not lit: Check corresponding plug-in connection for solenoid- operated valve and leads.Solenoid-operated valve internal resistance 0,7...1,7 Ω* All LEDs 4 and LEDs 3 not lit: Check ground connection of valve relay, valve relay defective.* Dimmer lighting-up of an LED means contact resistance in the corresponding circuit.* ABS warning lamp not lit: Warning lamp defective. Note: all other 5 LEDs lit.



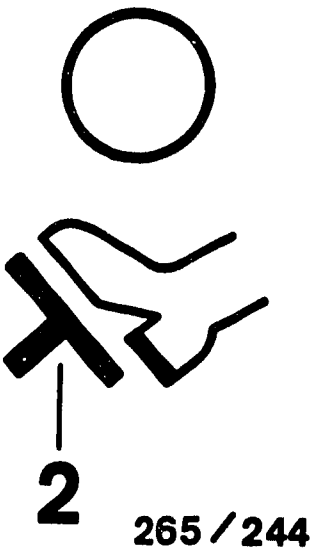
- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay
- 4 = Screws for
fastening plate



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch setting 2

Testing of (measurement at terminals)	Addition- al operation	Test specification (indication)	Possible causes of fault (see coordinate)
Oil-pressure- switch voltage (term.15)	Ignition on	LED 1 (top picture) lights up.	* LED sometimes does not go out until accelerator has been depressed (test is thus O.K.)
	Start engine	LED 1 (top picture) goes out when engine is running	* Check lead to oil-pressure switch. * Oil-pressure switch defective.
Brake-light switch (term. 25)	Ignition on	LED 2 (top picture) lights up	* Brake-light switch defective. * Check lead to brake-light switch.
	Press brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected at brake-light switch. * 6pole plug connection defective.

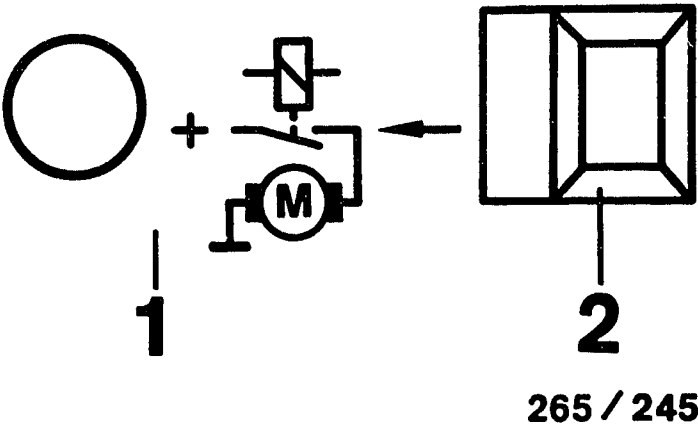


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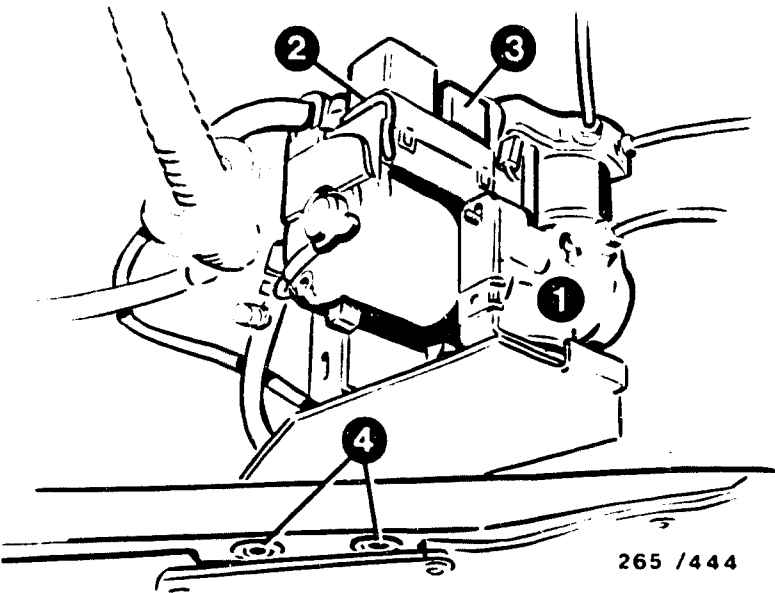
RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch setting 3

Testing of (measurement at terminals)	Additional operation	Test specifications (indication)	Possible causes of fault
Motor relay, pump motor in hydraulic modulator (term. 14 and term.28)	Ignition on, press button 2 contin- uously (top picture)	LED 1 lights up, pump motor running. After releasing button, LED continues to light up as a result of motor run-on (top picture).	<ul style="list-style-type: none">* Motor relay defective* Check ground connection and positive terminal of pump motor* Check following leads: from controller, term. 14 and term. 28 to hydraulic modulator, term. 9 or term. 11. Positive lead to hydraulic modulator, term. 10.* Pump motor or hydraulic modulator defective.



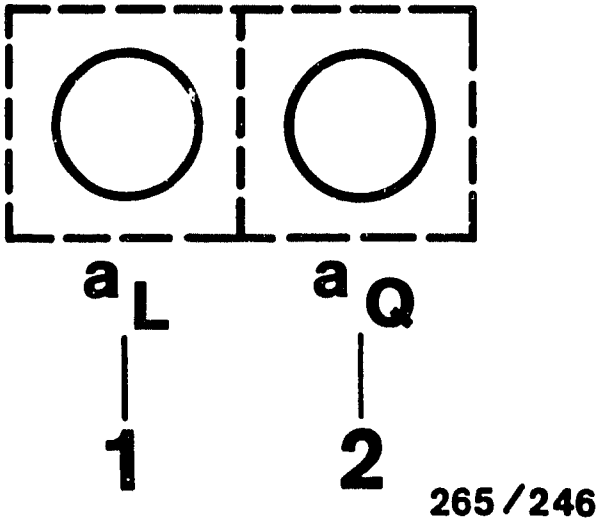
- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay
- 4 = Screws for
fastening plate



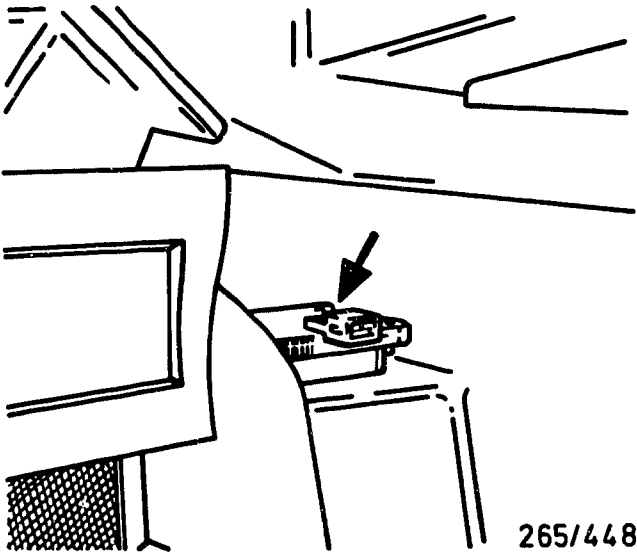
RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch setting 4

Testing of (measurement at terminals)	Additional operation	Test specification (indication)	Possible causes of fault
Lateral acceleration sensor a Q (term. 13)	Ignition on	LED a Q lights up	<ul style="list-style-type: none">* Check lateral acceleration sensor: Resistance: < 100 ΩWhen fitting sensor, do not forget spacer sleeves and pay attention to correct installation position.* Check lead from lateral acceleration sensor to ABS controller, term. 13.* Check lead from controller, term. 1 to lateral acceleration sensor.

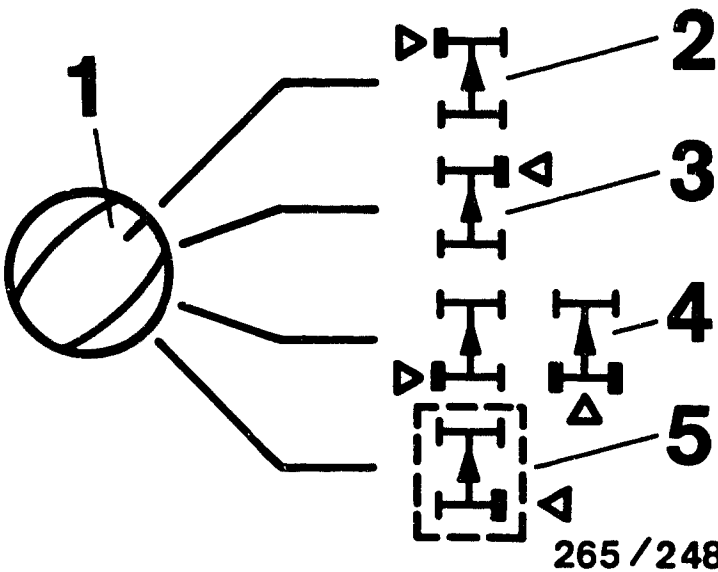
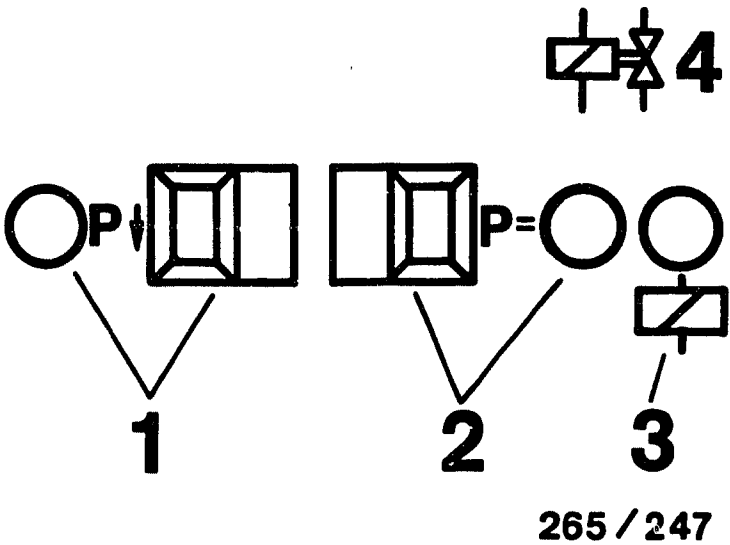


Arrow = Lateral acceleration sensor



RAPID DIAGNOSIS CHART (CONTINUED)
Program-selector-switch position 5 (3-channel hydraulic modulator)

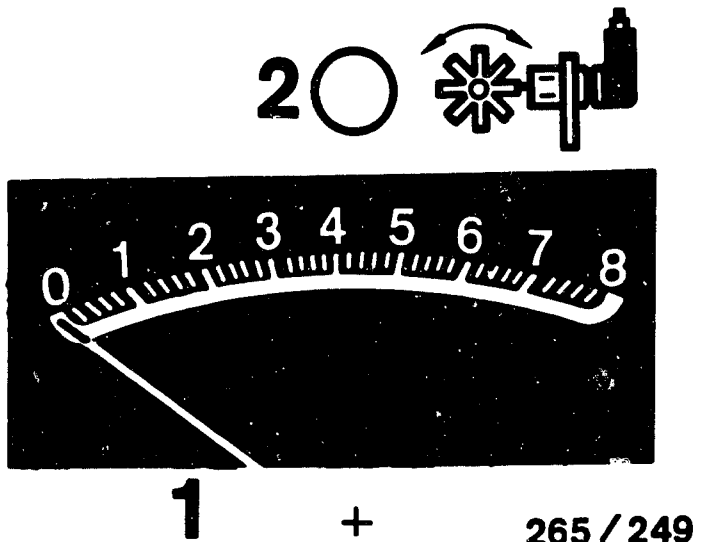
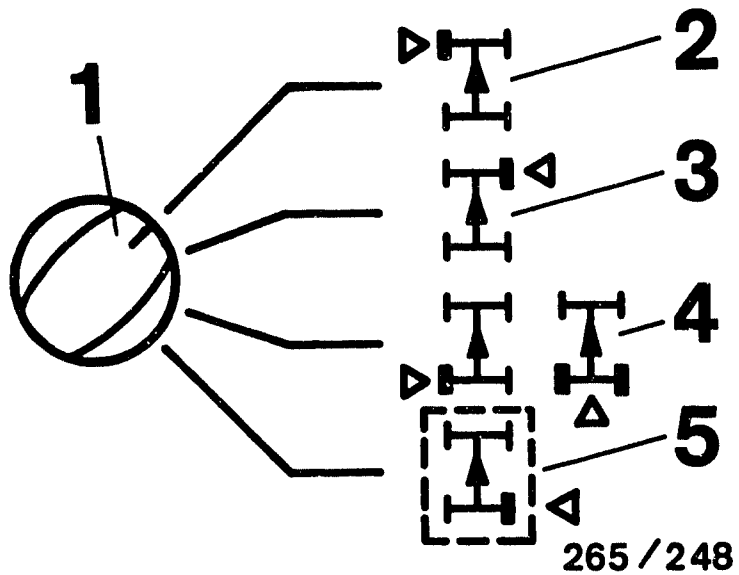
Test (measurement at terminals)	Additional operator action	Test specification (indication)	Possible fault causes
Valve-relay operation (term. 27)	Ignition on	LED 3 (upper illustration) lights up	* Valve relay (winding) or leads defective
Operation of solenoid valves in hydraulic modulator and connection correct way round. NOTE: Perform test consecutively for each wheel individually. Keep to operational sequence.	Jack up vehicle. Switch on ignition. You must be able to turn wheel under test freely by hand. Set switch 1 for wheel selection to the wheel under test. For rear axle, set to pos.4 (center illus.).		* Repeat test with engine running * Valve relay (working contact) defective * Open circuit in lead from valve relay term. 87 to B+ * Brake lines on hydraulic modulator mixed up
Pressure-holding function	1. Hold button P= (upper illus.) constantly pressed	LED P= (upper illus.) lights up	* Current value not reached (LED P arrow or P= go out; upper illustration): Battery inadequately charged. Repeat test with engine running.
	2. Hold brake pedal down constantly	Wheel can be turned by hand	
	3. Release button P= (upper illus.)	LED P= goes out (upper illus.) Wheel blocked	
Pressure-reduction function	4. Press button P arrow (upper illus.)	LED P arrow (upper illus.) lights up, wheel can be turned by hand	* Electrical connections of solenoid valves correct? Wheel front left: term. 2 Wheel front right: term.35 Wheel rear left: term.— Wheel rear right: term.— Rear axle: term.18 * Hydraulic modulator defective
	5. Release button P arrow (upper illus.)	LED P arrow (upper illus.) goes out, wheel blocked	
	6. Release brake pedal		



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 6 (4 wheel-speed sensors)

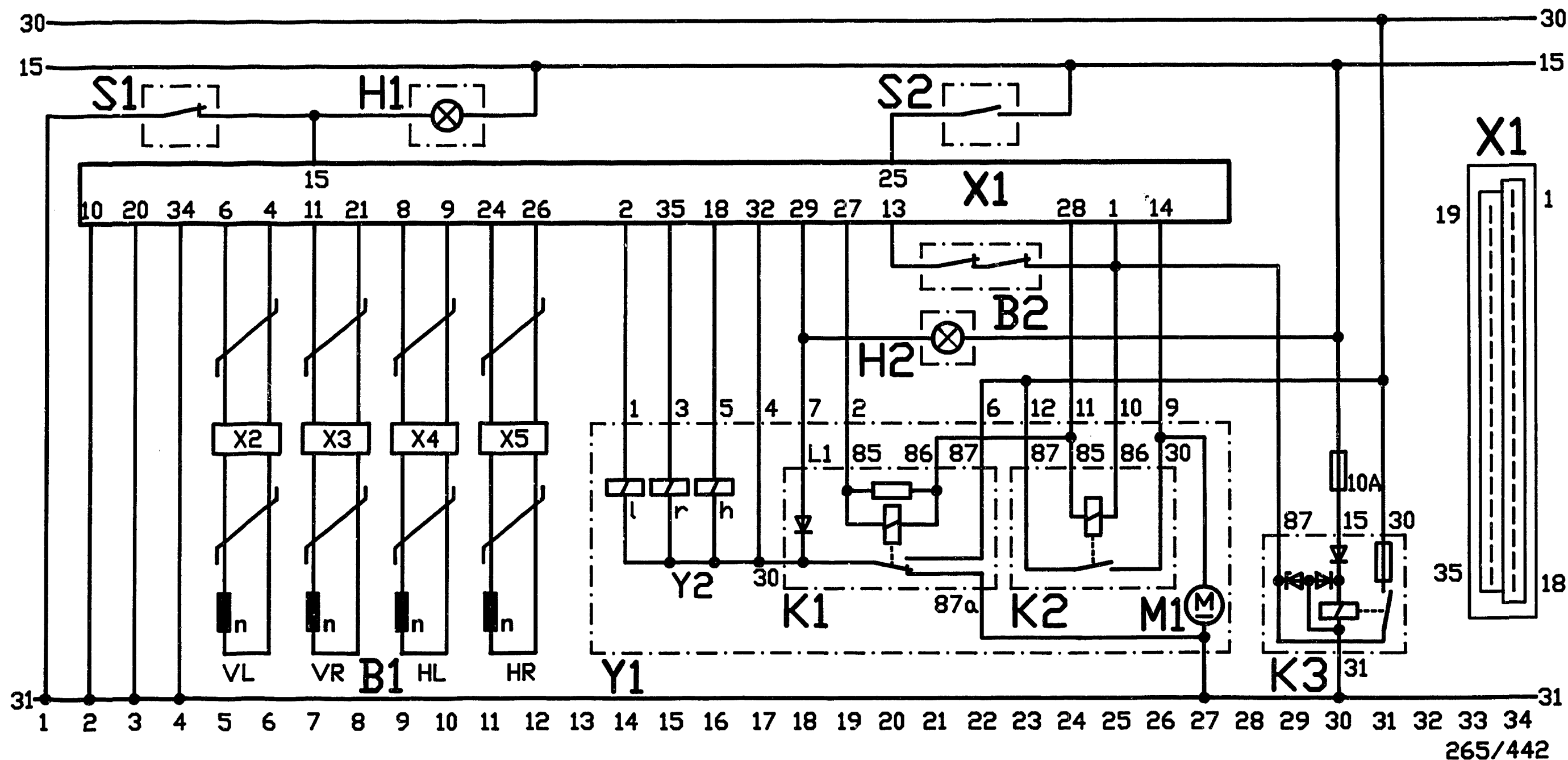
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Wheel-speed sensor for operation and mix-up NOTE: Check each wheel separately in turn. Wheel, front left: term.4 and t.6 Wheel, front right: term.11 and term.21 Wheel, rear left: term.8 and term.9 Wheel, rear right: term.24 and term.26	Chock-up vehicle. Ignition on. The wheel being tested must be freely turn- able by hand. When testing the driven axle, the wheel not being tested must be locked. Set switch for wheel selection to wheel to be tested (lower illustration) Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (upper illustration)	1. Smallest reading larger 1,6 <u>divisions</u> 2. Permissible fluctuation max. 25 % of largest reading.	*Wheel-speed-sensor lead mixed up *Brake in wheel-speed- sensor lead *Wheel-speed sensor defective Winding resistance Front axle: 0,6...1,6 k Ω Rear axle: 0,6...1,6 k Ω *Air gap between wheel- speed sensor and ring gear too wide *Ring gear defective (e.g. corroded, dirty) or loose. *Ring gear with incorrect number of teeth installed Front axle: 41 teeth Rear axle: 44 teeth *Wheel-bearing clearance too large *Instrument gives reading, LED 2 does not light up: loose contact in wheel- speed sensor lead.



TEST SPECIFICATIONS

Wheel-speed sensor		
* Winding resistance at ambient temperature (-10°C...+120°C) for front wheels:	600...1600	Ω
rear wheels:	600...1600	Ω
Hydraulic-modulator solenoid valves		
* Winding resistance at ambient temperature (-10°C...+120°C):	0,7... 1,7	Ω
Air gap between wheel-speed sensor and ring gear		
* at front wheels:	0,1...0,87	mm
* at rear wheels:	0,1...0,95	mm
Tightening torque for		
* fastening screws of wheel-speed sensors:	> 8	Nm
* Brake-line connections at hydraulic modulator:	12... 16	Nm
* Fastening screws for wheel-speed-sensor mount		
at front wheels:	8	Nm
at rear wheels:	40	Nm
Number of teeth on wheel-speed-sensor ring gears		
* at front wheels:	41	teeth
* at rear wheels:	44	teeth
Lateral acceleration sensor		
* Contacts closed in horizontal position:	< 100	Ω

For production reasons:
continued on the following
coordinate.



B1 = Wheel-speed sensor
 B2 = Lateral acceleration sensor
 H1 = Oil-pressure warning lamp
 H2 = ABS warning lamp
 K1 = Valve relay
 K2 = Motor relay

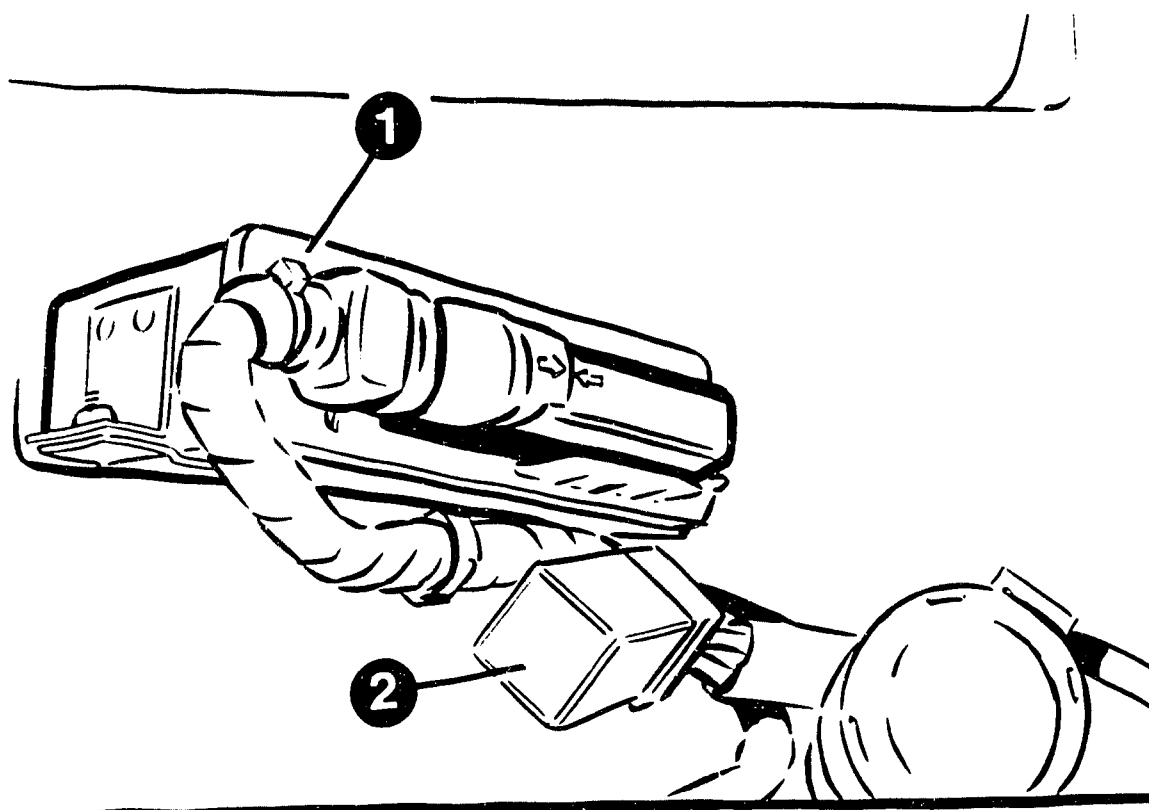
K3 = Over-voltage protection
 relay
 M1 = Return-pump motor
 S1 = Oil-pressure switch
 S2 = Brake-light switch
 X1 = Controller plug (35 pole)
 X2...X5 = Wheel-speed-sensor plug

Y1 = Hydraulic modulator
 Y2 = Solenoid valves
 HL = Rear left
 HR = Rear right
 h = Rear axle
 VL = l = Front left
 VR = r = Front right

ELECTRICAL TERMINAL DIAGRAM 12.86 ->

F21 — ==>

F22 — <==



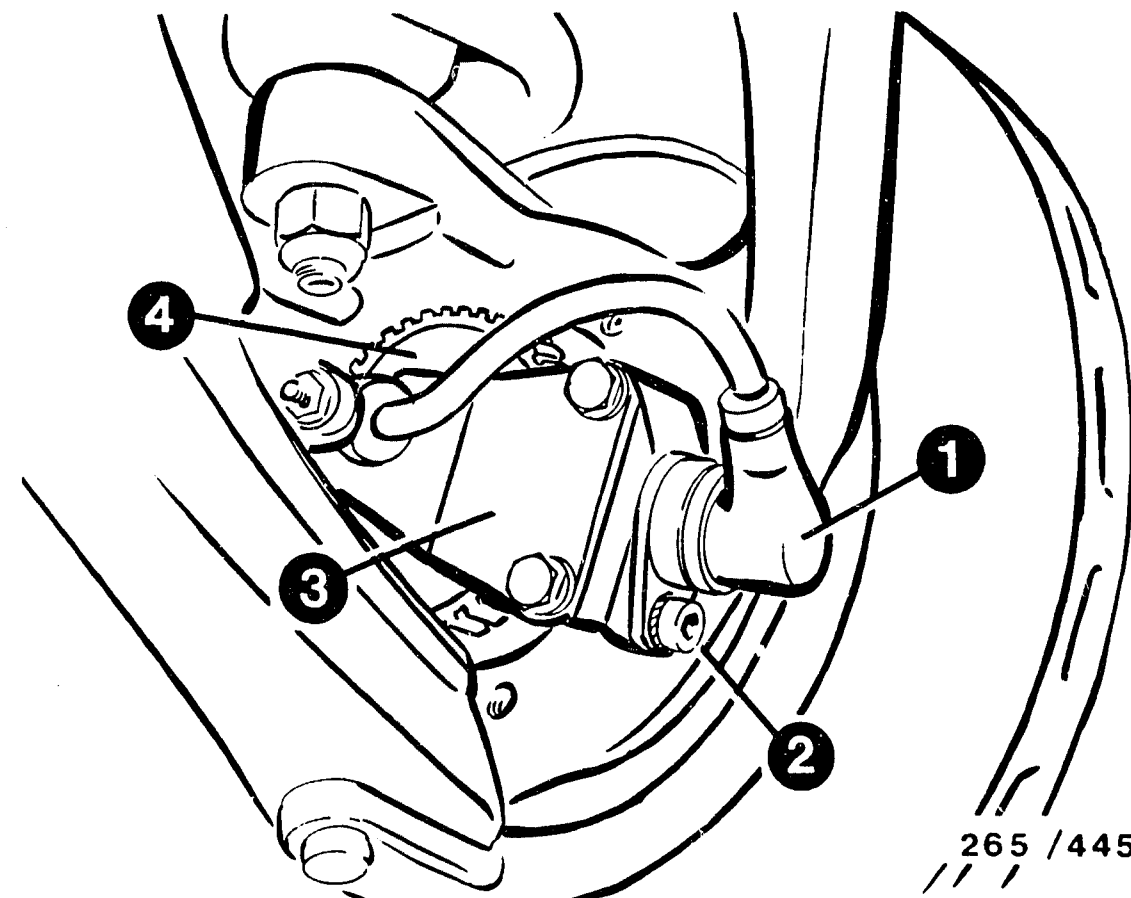
265 / 443

- 1 = ABS controller
- 2 = Over-voltage protection relay

INSTALLATION POSITION OF COMPONENTS

The information given on installation locations always refers to the direction of travel.

- * ABS controller:
Up to approx. mid 88: in trunk, on right-hand side next to battery beneath a cover.
As of approx. mid 88: in trunk, on right-hand side beneath trunk lining. Remove complete lining.
- * Over-voltage protection relay:
In trunk, on left-hand side next to battery or in trunk, on right-hand side beneath trunk cover.
- * ABS warning lamp:
In instrument panel. Symbol: swerving vehicle.

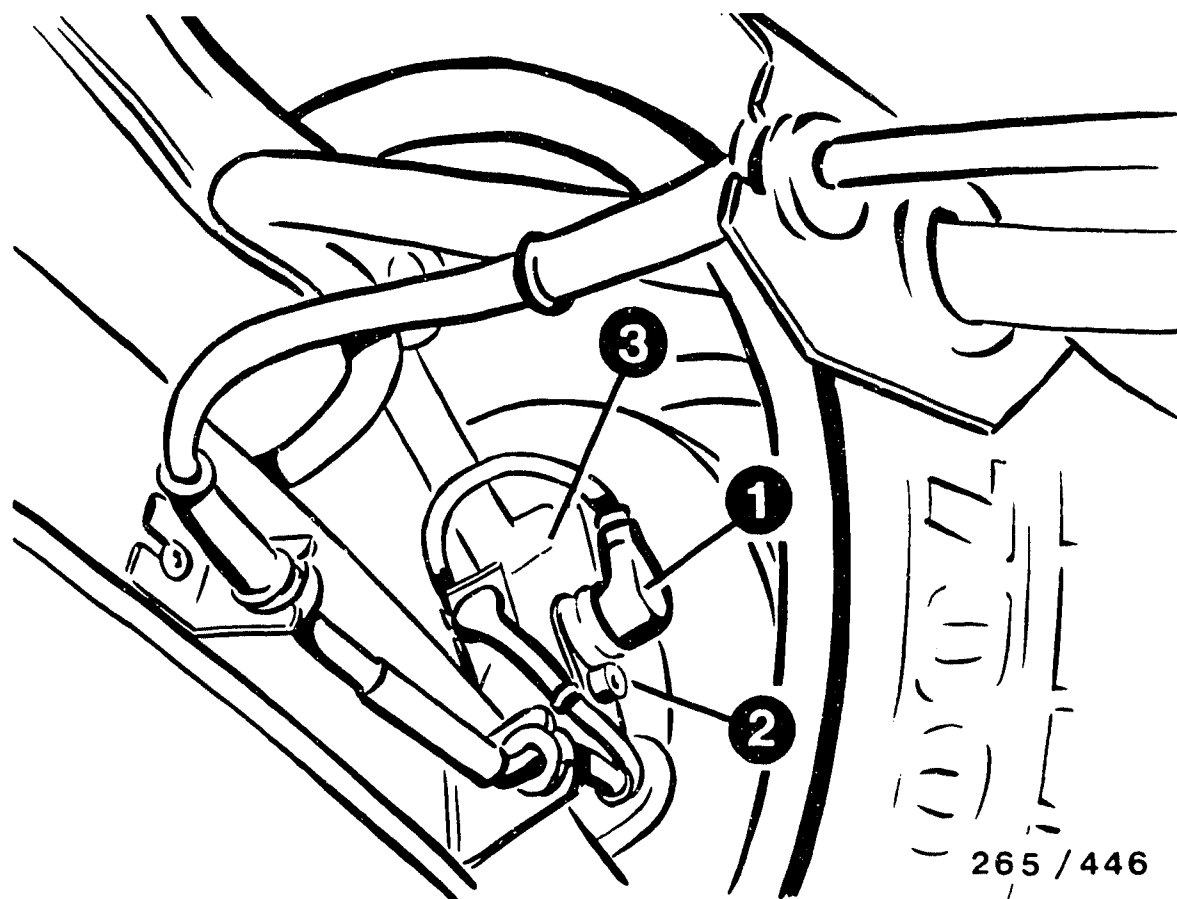


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- 1 = Wheel-speed sensor, front
Do not unscrew mount (3) when removing!
- 2 = Fastening screw
- 4 = Ring gear

INSTALLATION POSITION OF COMPONENTS (continued)

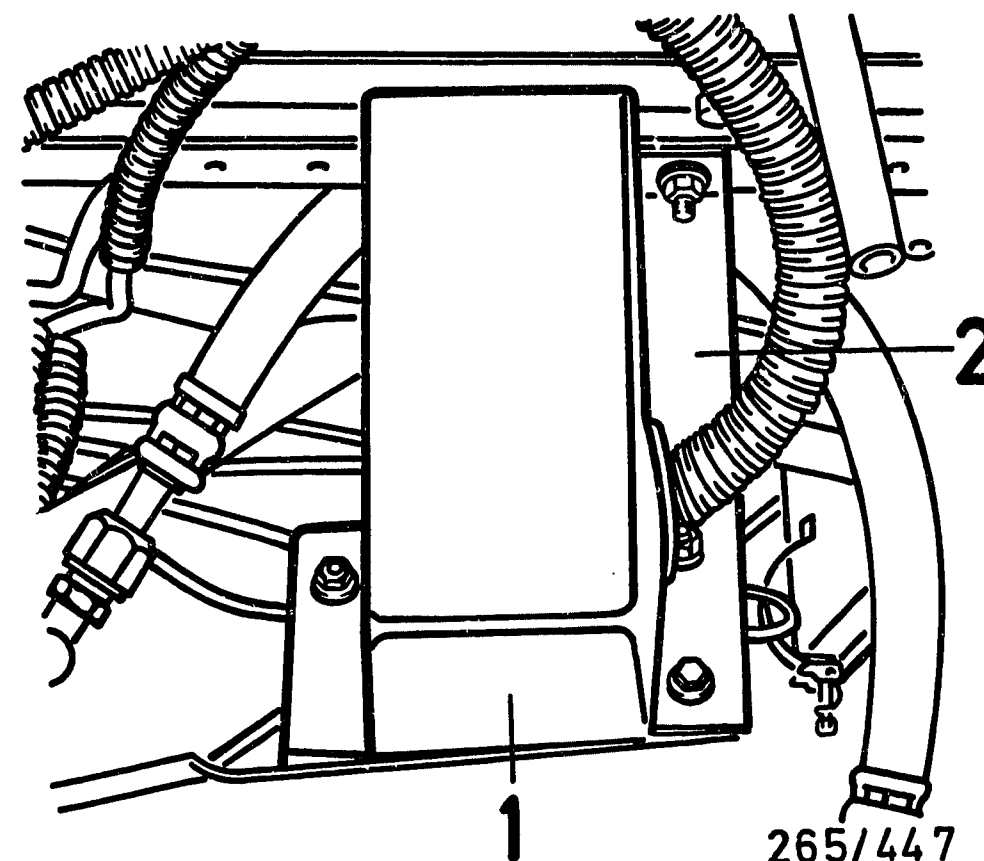
- * Wheel-speed sensor, front axle:
One each on left and right at steering-knuckle supports.
Plug connections in front wheel houses.
- * ABS ground terminal:
In front of battery, at bottom.



- 1 = Wheel-speed sensor, rear
Do not unscrew mount (3) when removing!
- 2 = Fastening screw

INSTALLATION POSITION OF COMPONENTS (continued)

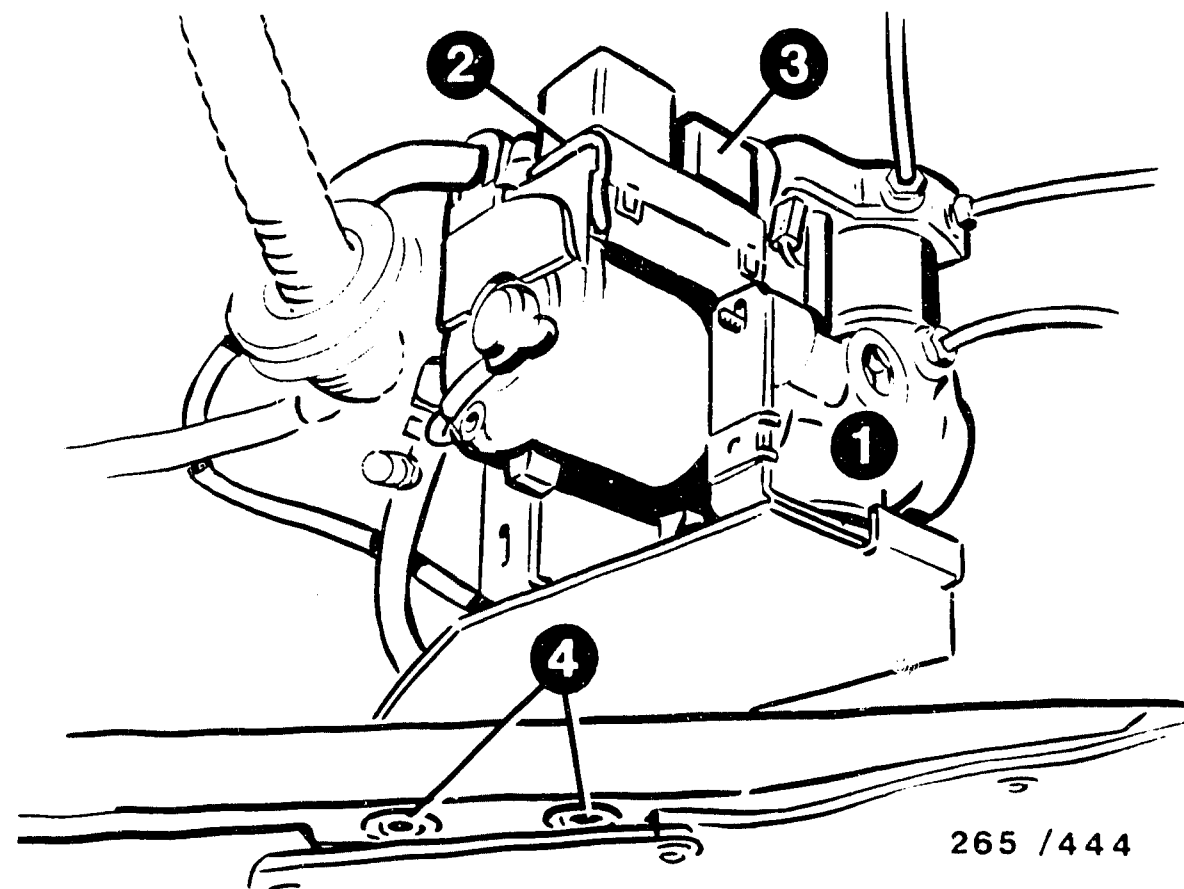
- * Wheel-speed sensor, rear axle:
One each on left and right opposite brake caliper.
Plug connections underneath vehicle on left and right at cross-member.
- * Braking-force regulator:
Beneath vehicle, at rear; to the left of the transmission.



- 1 = Cover
2 = Retaining bracket

INSTALLATION POSITION OF COMPONENTS (continued)

- * Hydraulic modulator:
In wheel house, front right, behind a cover.
The hydraulic modulator cannot be repaired, but rather it is to be replaced as a complete unit.
Exception: relay change.

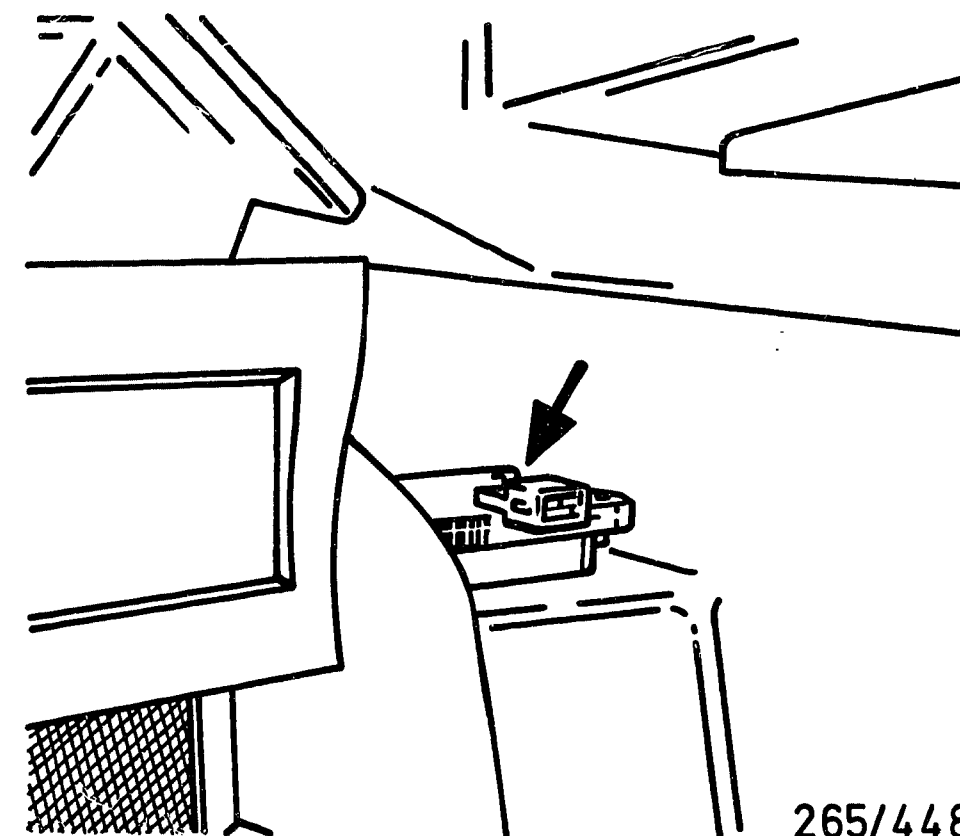


- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay
- 4 = Screws for fastening plate

INSTALLATION POSITION OF COMPONENTS (continued)

Removal instructions for changing relay:
 Remove protective cover above hydraulic modulator including retaining bracket.
 Loosen fastening plate to enable hydraulic modulator to be lowered somewhat.
 Loosen Torx screw in hydraulic-modulator cover.
 Pull out cover first upwards and then forwards.

Before removing hydraulic modulator, mark brake-line connections in line with marking on hydraulic modulator. Ensure correct connection of brake lines when installing.



Arrow = Lateral acceleration sensor

INSTALLATION POSITION OF COMPONENTS (continued)

- * Lateral acceleration sensor:
 Beneath instrument panel in transmission tunnel.
 Remove right-hand tunnel cover.
 When fitting, observe direction of installation and do not forget spacer sleeves.

Trouble-shooting instructions : MB-5040

BOSCH system : EI-K

Make of vehicle : Mercedes Benz

Basic microcard : PKW-102

TABLE OF CONTENTS

Section	Coordinates
Special features, usage, safety	02
Trouble-shooting chart	03
Self-diagnosis test table	05
Rapid diagnosis chart	13
Test specifications	21
Electrical terminal diagram	23
Installation position of components, removal and installation instructions	27

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Mercedes Benz models:

420 SE, SEL, SEC version CAT/retrofit vehicles 09.87 ->
Engine 116.965, 4.2 l, 8 cyl. 165/170 kW

500 SE, SEL, SEC version CAT/retrofit vehicles 09.87 ->
Engine 117.965, 5.0 l, 8 cyl. 185/195 kW

560 SEL, SEC version CAT/retrofit vehicles 09.87 ->
Engine 117.968, 5.6 l, 8 cyl. 205/220 kW

* EI-K control unit 0 227 400 7..
(with current limitation)

* Ignition coil 0 221 5.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems
(Engine speed, exhaust gas).
4. Poor throttle take-up,
flat spot during acceleration.
5. Engine missing
(ignition, injection).
6. Maximum engine power/top
speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

[illegible]

TROUBLE-SHOOTING CHART (continued)

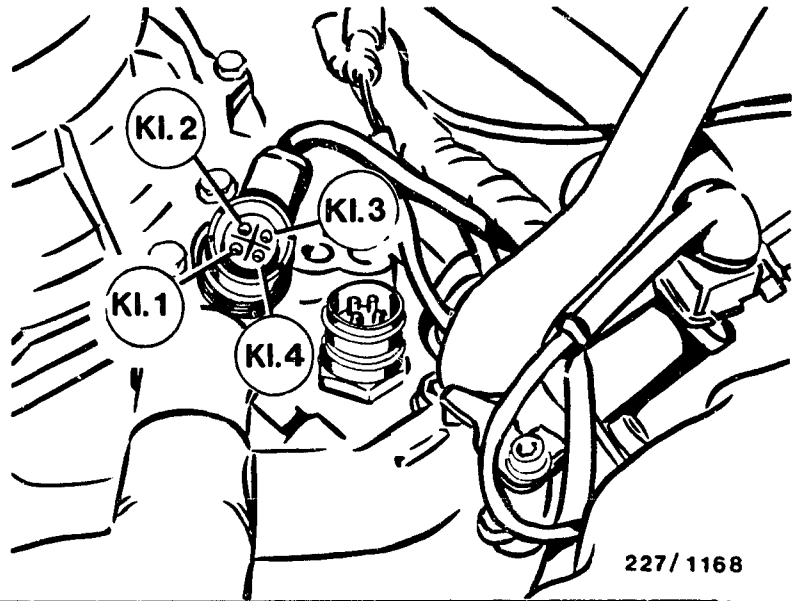
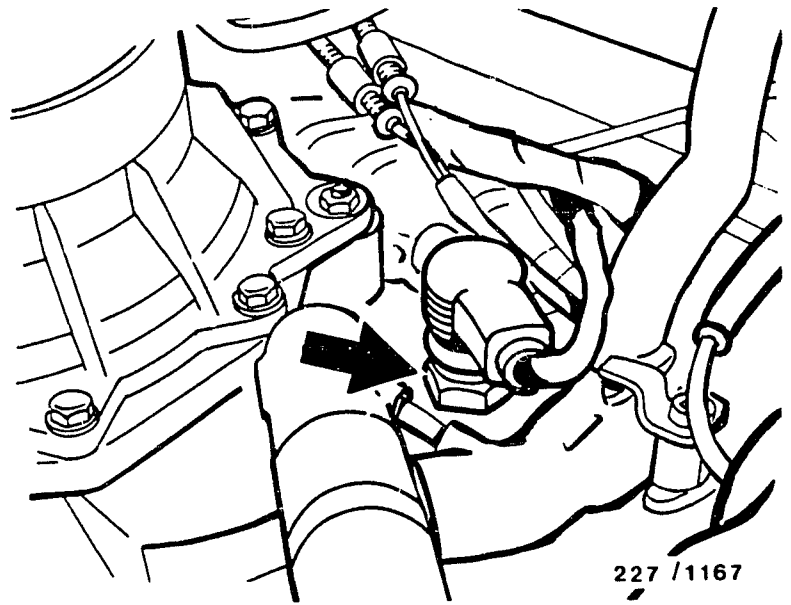
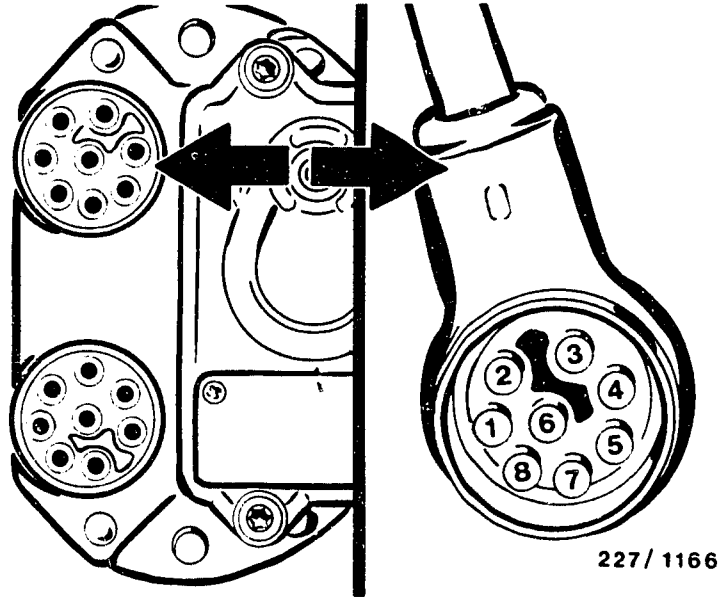
Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)
*										Pulse-generator internal resistance
*										Contact resistances (primary side)
*										Primary signal
*										Peak-coil-current cutoff
			*							Voltage: EI-K control unit, ignition coil (engine idling)
			*							Primary voltage
*	*	*	*	*	*	*	*	*	*	Spark-advance angle
		*								Throttle-valve switch, idle
				*						Throttle-valve switch, full load

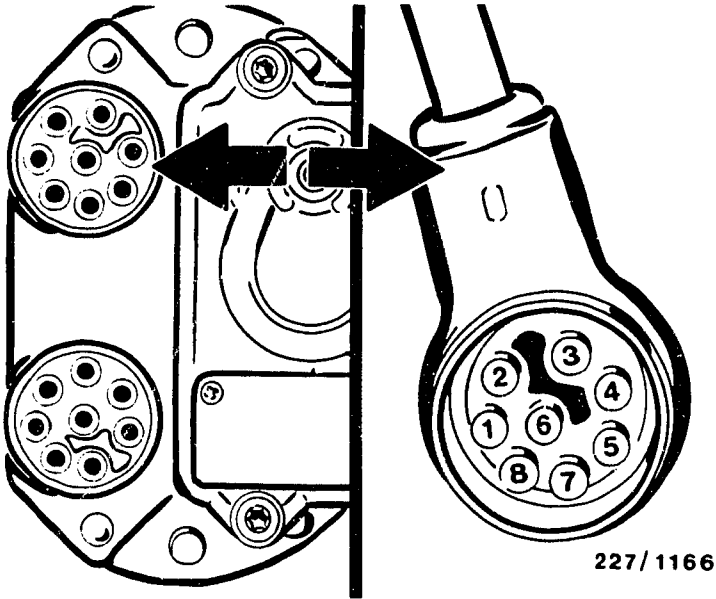
SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function Test instructions/conditions	Term- inals	Set values
1	NO FAULT STORED	—	—
2	<p>MAXIMUM RETARD (of at least 1 cylinder is attained) AFTER-SALES-SERVICE TESTING OF FLASHING CODE NOT POSSIBLE</p> <p>Fuel with inadequate octane number, increase in compression e.g. due to coking, abnormal engine noise (valves, camshaft, piston, bearings).</p>	—	—
3	<p>COOLANT TEMPERATURE SENSOR</p> <p>Detach EI-K control-unit plug. See top picture, arrow. Detach temperature-sensor plug. See center picture, arrow.</p> <p>Resistance of EI-K control-unit plug and temperature-sensor plug. See top and bottom pictures.</p> <p>* = Approx. 0 Ω (continuity) must be indicated for one of the 4 terminals.</p> <p>Resistance of EI-K control-unit plug and temperature-sensor plug</p> <p>** = Approx. 0 Ω (continuity) must be indicated for one of the 4 terminals.</p> <p>Continued on next picture page</p>	<p>4 1 2 3 4</p> <p>5 1 2 3 4</p>	<p>Approx. 0 Ω * Approx. 0 Ω * Approx. 0 Ω * Approx. 0 Ω *</p> <p>Approx. 0 Ω ** Approx. 0 Ω ** Approx. 0 Ω ** Approx. 0 Ω **</p>

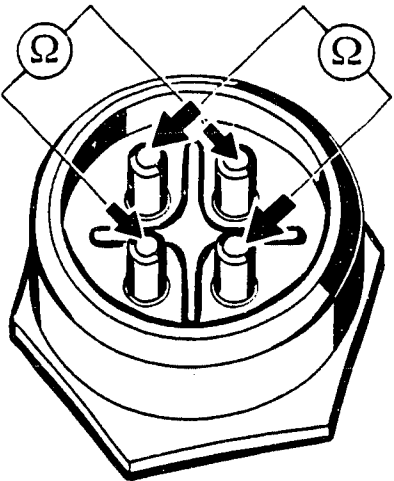


SELF-DIAGNOSIS TEST TABLE (continued)

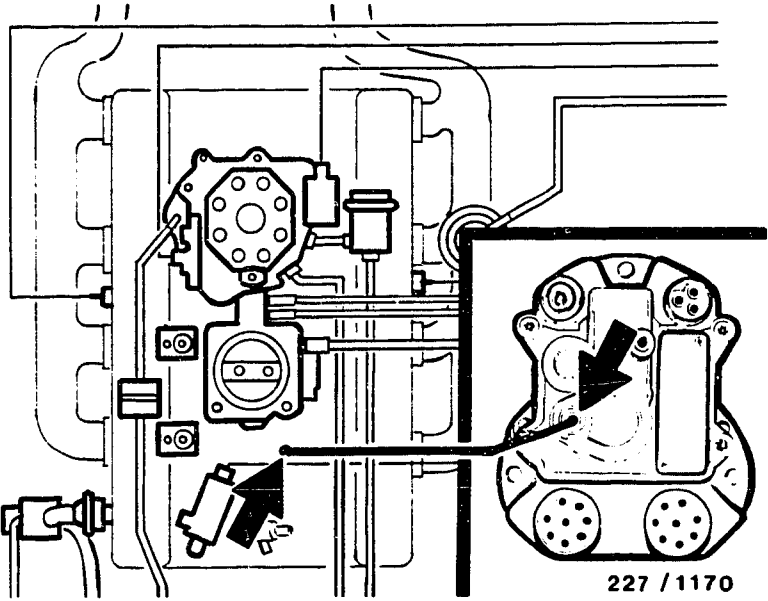
Fault indication Flashing code	Testing of component/function Test instructions/conditions	Term-inals	Set values
3	<p>COOLANT TEMPERATURE SENSOR (continued)</p> <p>Resistance of vehicle ground and EI-K control-unit plug. See top picture, arrow.</p> <p>Coolant-temperature-sensor resistance.</p> <p>* Note: Test both temperature sensors (Measure diagonally).</p> <p>See center picture.</p>	<p>B- 4</p> <p>B- 5</p> <p>*</p>	<p>infinity Ω</p> <p>infinity Ω (Open-circuit)</p> <p>+20° C 2,1...2,9 k Ω</p> <p>+30° C 1,4...2,0 k Ω</p> <p>+80° C 280...370 Ω</p> <p>+90° C 210...280 Ω</p> <p>+100°C 160...215 Ω</p>
4	<p>PRESSURE SENSOR</p> <p>Leak test, vacuum hose EI-K control unit to throttle-valve-assembly plug connection. See bottom picture, arrow. If leak test O.K., renew EI-K control unit.</p>	—	—
5	<p>KNOCK SENSORS</p> <p>Knock sensors defective. Knock-sensor tightening torque</p>	—	15...25 Nm



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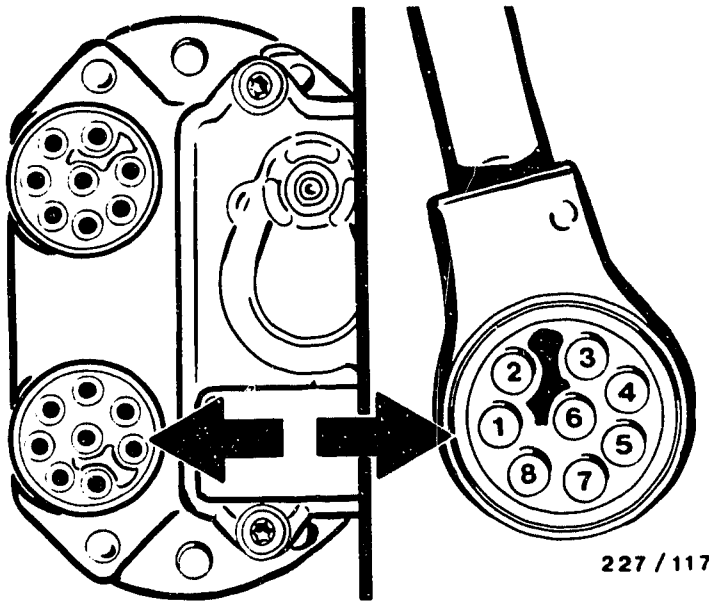
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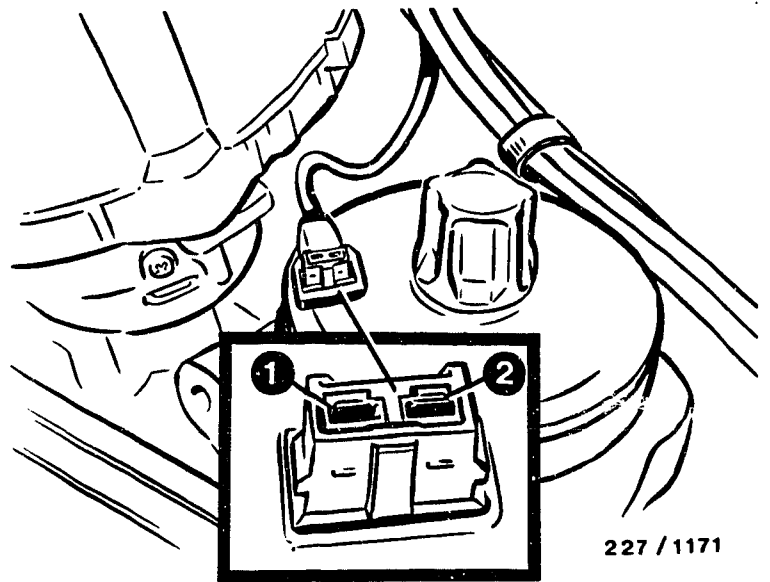
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SELF-DIAGNOSIS TEST TABLE (continued)

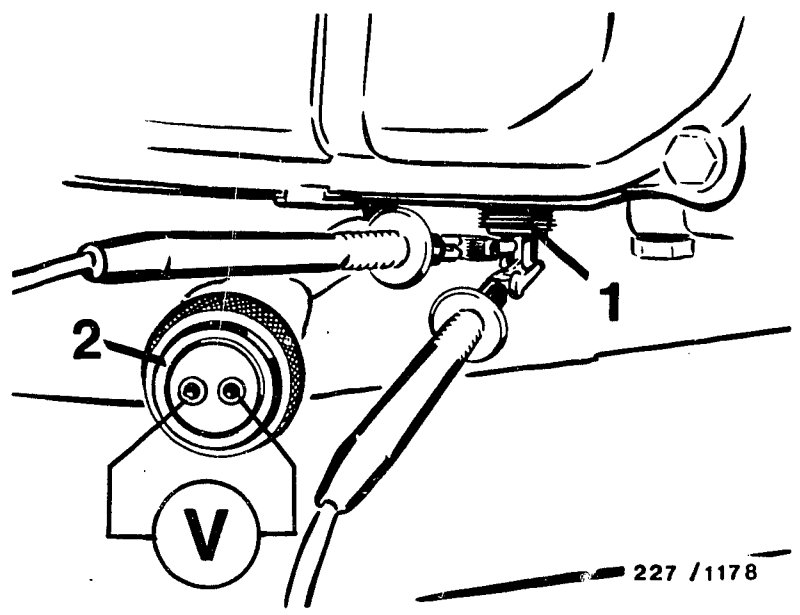
Fault indication Flashing code	Testing of component/function Test instructions/conditions	Terminals	Set values
6	<p>PULSE GENERATOR – CYLINDER RECOGNITION</p> <p>Detach EI-K control-unit and ignition-distributor plug. See top and center pictures. Resistance of EI-K control-unit and ignition-distributor plug.</p> <p>Resistance of EI-K control-unit plug.</p> <p>Attach ignition-distributor plug. Resistance of EI-K control-unit plug.</p> <p>Resistance of EI-K control-unit plug and ignition-distributor housing (ground).</p>	<p>7 1 5 2</p> <p>5 7</p> <p>5 7</p> <p>7 B-</p>	<p>Approx. 0 Ω (continuity)</p> <p>Approx. 0 Ω (continuity)</p> <p>infinity Ω (Open-circuit)</p> <p>900...1600 Ω</p> <p>infinity Ω (Open-circuit)</p>
7	<p>EI-K CONTROL UNIT (evaluation circuit) EI-K control unit defective.</p>	—	—
8	<p>TRANSMISSION OVERLOAD PROTECTION SWITCH (does not close) Resistance of transmission overload protection switch. See bottom picture, item 1.</p> <p>Engine idling. Actuate foot-operated parking brake. Observe safety regulations (e.g. chocks at rear wheels). Transmission selector lever in: Position " N " or " P "</p> <p>Position " D "</p> <p>Voltage, coupling, transmission overload protection switch. See bottom picture, item 2. Ignition ON.</p>	<p>—</p> <p>—</p> <p>—</p>	<p>Greater than 20 k Ω (Open-circuit)</p> <p>Less than 1 Ω (Continuity)</p> <p>Approx. 10 V</p>



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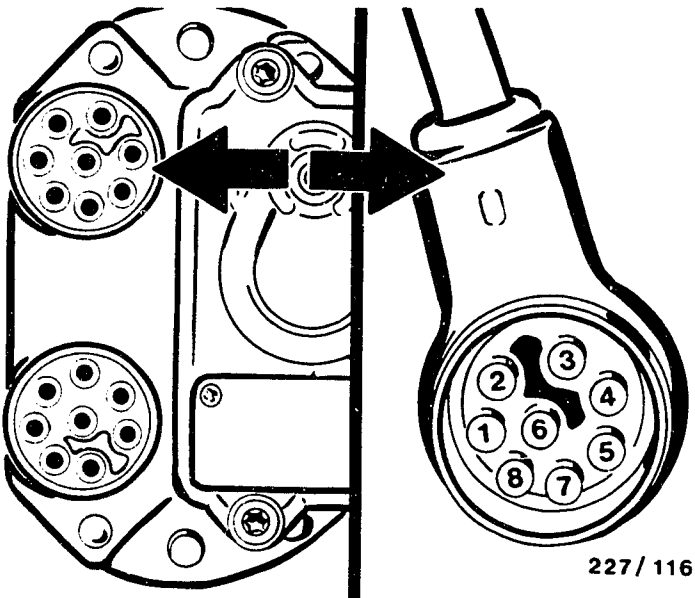
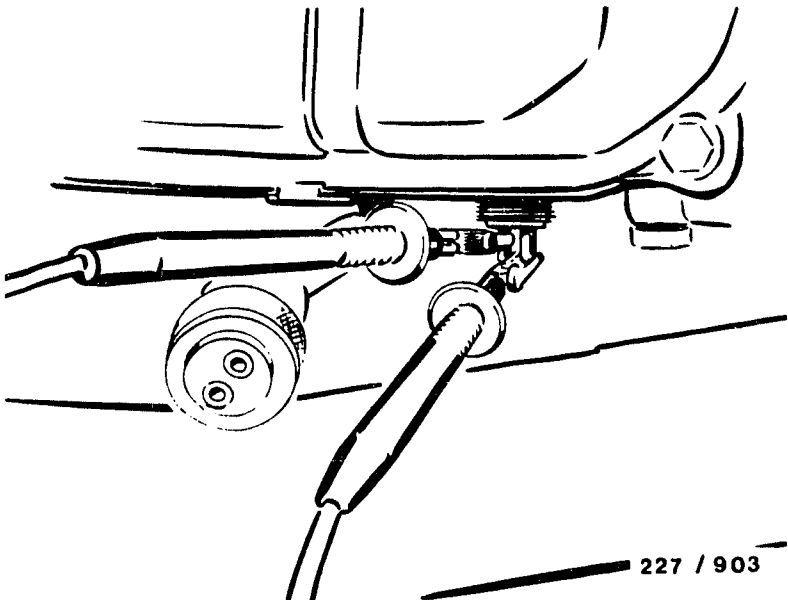
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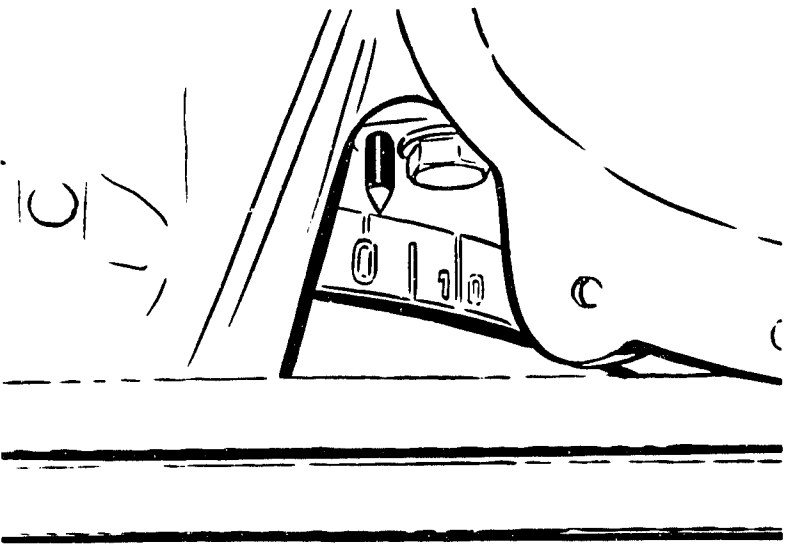
SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function Test instructions/conditions	Terminals	Set values
9	<p>TRANSMISSION OVERLOAD PROTECTION SWITCH (doesn't open)</p> <p>Resistance of transmission overload protection switch. See top picture. Engine idling. Actuate foot-operated parking brake.</p> <p>Observe safety regulations (e.g. chocks at rear wheels). Gear selector lever in: Position "N" or "P"</p> <p>Position "D"</p> <p>Detach EI-K control-unit plug. See bottom picture. Coupling, transmission overload protection switch detached. Resistance of EI-K control-unit plug and vehicle ground.</p>	<p>—</p> <p>—</p> <p>1 B-</p>	<p>Greater than 20 k Ω (Open-circuit)</p> <p>Less than 1 Ω (Continuity)</p> <p>infinity Ω (Open-circuit)</p>

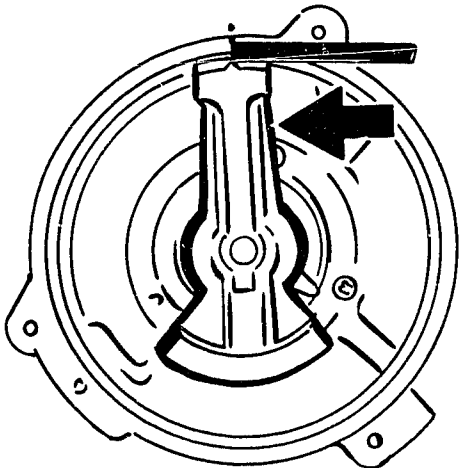


RAPID DIAGNOSIS CHART

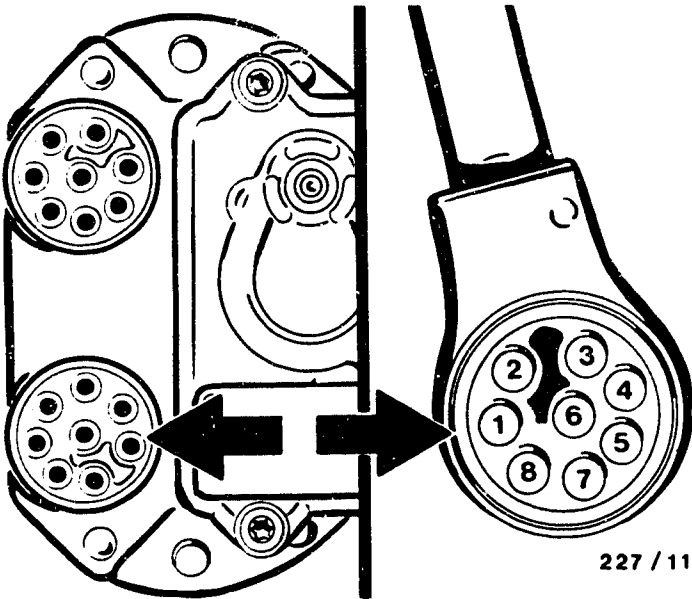
Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
1	HIGH-TENSION END Check function, for example, of spark plugs, ignition harness and distributor cap (e.g. open-circuit, shunt). Assessment, for example, by way of ignition oscillogram, resistance measurement, visual inspection.	—	—
2	IGNITION COIL Primary resistance Secondary resistance	1 15 1 4	0,2... 0,4 Ω 7,3...13,2 k Ω
3	IGNITION-DISTRIBUTOR SETTING (high-tension end) Engine cyl. 1 TDC. Distributor rotor points to housing mark. See top and center pictures.		
4	EI-K CONTROL-UNIT VOLTAGE Detach EI-K control-unit plug. See bottom picture, arrow. Ignition ON. Voltage of EI-K control-unit plug.	6 2 (+) (-)	Battery voltage
5	PRIMARY-CIRCUIT VOLTAGE EI-K control-unit plug detached. See bottom picture, arrow. Ignition ON. Voltage of EI-K control-unit plug	1 2 (+) (-)	Battery voltage



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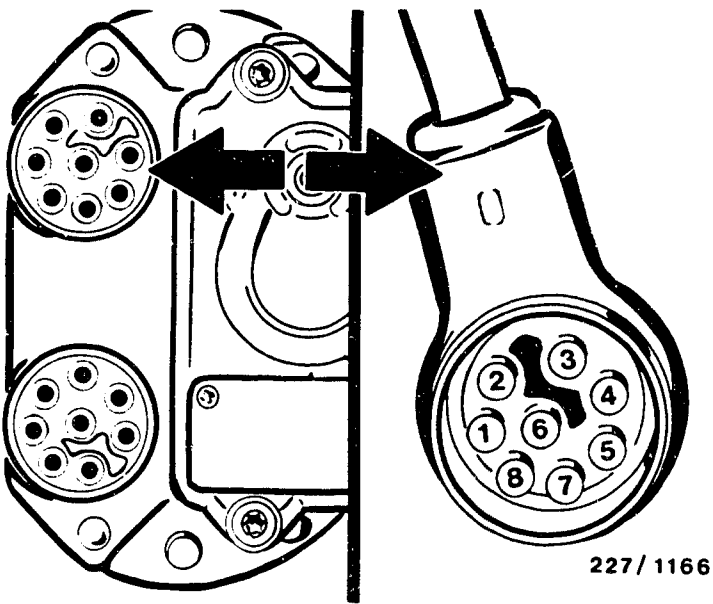
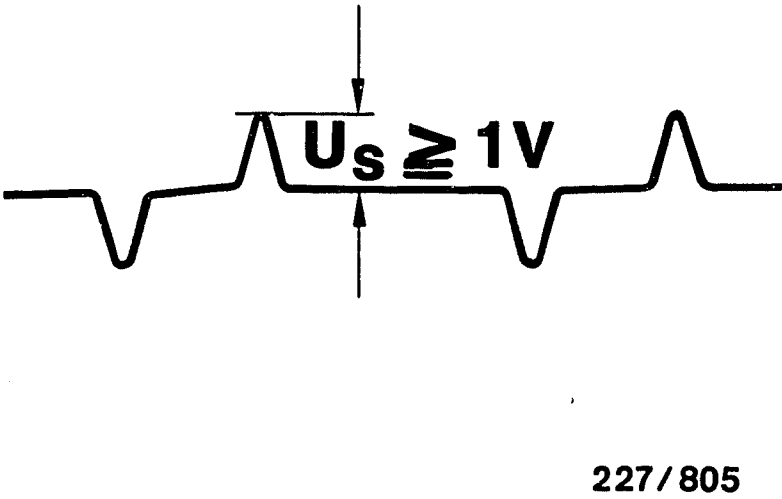
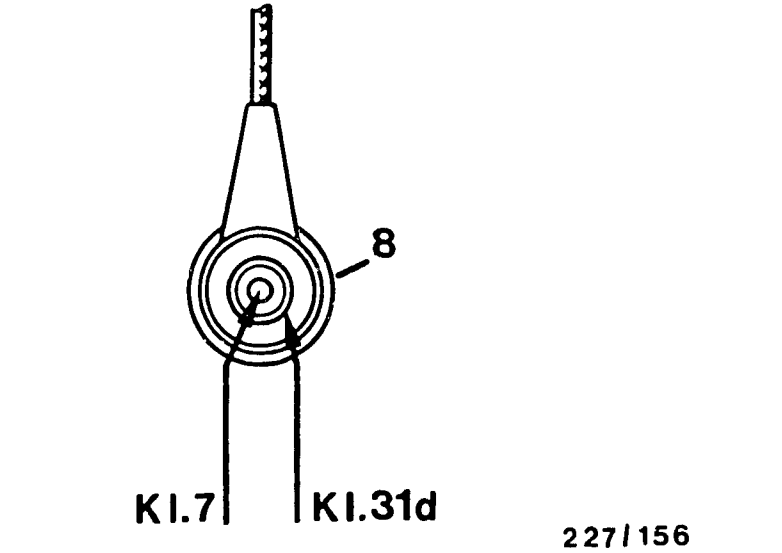
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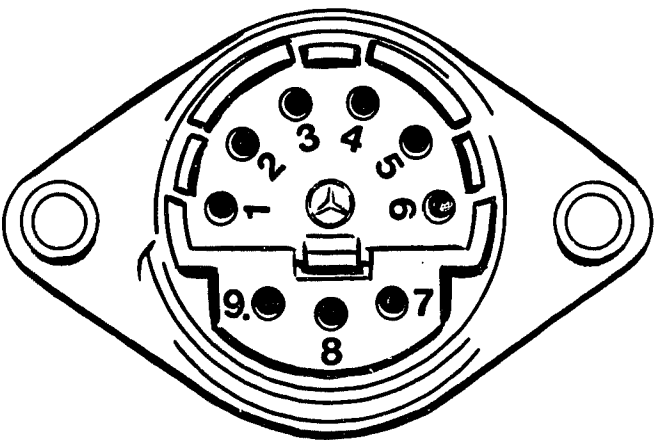
RAPID DIAGNOSIS CHART (continued)

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
6	PULSE-GENERATOR INSULATION EI-K control-unit plug detached. See top picture. Resistance of EI-K control-unit plug and vehicle ground.	7 B-	infinity Ω (Open-circuit)
7	PULSE-GENERATOR INTERNAL RESISTANCE EI-K control-unit plug detached. See top picture. Resistance of EI-K control-unit plug	7 31d	680...1200 Ω
8	PULSE-GENERATOR VOLTAGE EI-K control-unit plug detached. See top picture. Connect oscilloscope "special" to EI-K control-unit plug. Start engine.	7 31d (+) (-)	Equal to/greater than 1,0 V (Center picture)
9	CONTACT RESISTANCES (primary side) Disconnect negative and positive leads from battery. EI-K control-unit plug detached. See bottom picture, arrow. Ignition ON. Resistance from battery terminal to EI-K control-unit plug. Resistance from battery term. to ignition coil Resistance from ignition coil to EI-K control-unit plug.	B+ 6 B- 2 B+ 15 1 1	max. 0,3 Ω max. 0,3 Ω



RAPID DIAGNOSIS CHART (continued)

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
10	PRIMARY SIGNAL Attach all EI-K control-unit plugs. Connect oscilloscope/engine-speed tester to ignition coil. Start engine.	15 1 (+) (-)	Primary voltage/ engine-speed display (magnitude irrelevant)
11	PEAK-COIL-CURRENT CUTOFF Diagnosis-socket voltage. Ignition ON. See top picture.	5 4 (+) (-)	After approx. 1 s 0 V
12	VOLTAGE OF EI-K CONTROL UNIT, IGNITION COIL Voltage, diagnosis socket and battery terminal. See top picture. Engine idling.	5 B- (+) (-)	12-14 V max. 1 V below U _B
13	PRIMARY VOLTAGE Connect oscilloscope with pulse-shaping circuit to ignition coil. Engine idling.	15 1 (+) (-)	200...290 V (Bottom picture)
14	SPARK-ADVANCE ANGLE Vacuum hose, EI-K control unit attached. Engine at operating temperature, however less than 95 °C. Engine idling (650...750 min ⁻¹).	—	14°...18° BTDC

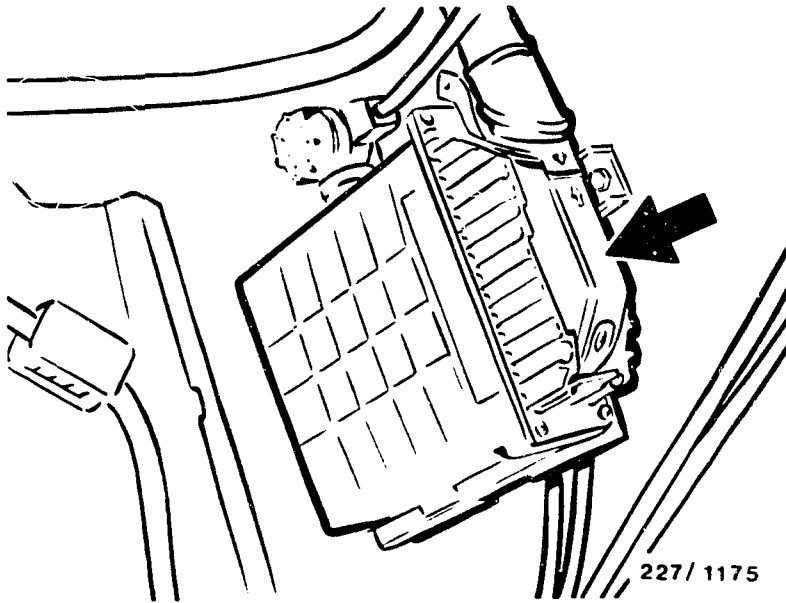
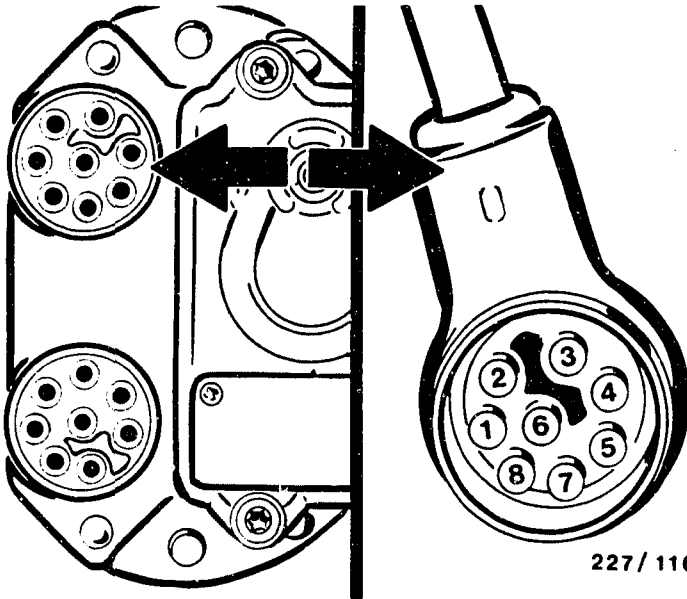
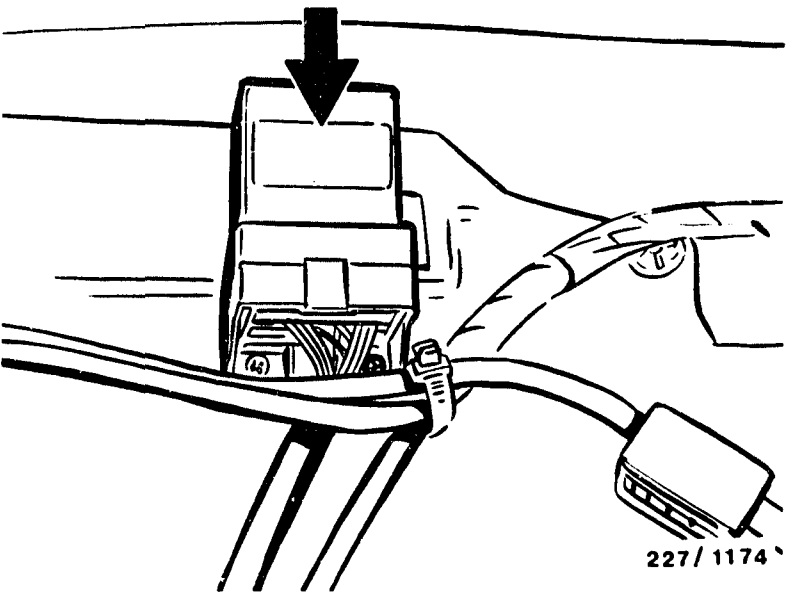


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227/1010

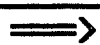
Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
15	<p>THROTTLE-VALVE SWITCH - IDLE</p> <p>Detach control-unit plug, idle-speed regulation. See top picture, arrow. Detach EI-K control-unit plug. See center picture, arrow. Resistance of EI-K control-unit plug and vehicle ground. Accelerator pedal in off-position. Accelerator pedal in part-load position.</p>	7 B-	<p>Approx. 0 Ω (Continuity) infinity Ω (Open-circuit)</p>
16	<p>THROTTLE-VALVE SWITCH - FULL LOAD</p> <p>Detach KE-Jetronic control-unit plug. See bottom picture, arrow. Detach EI-K control-unit plug. See center picture, arrow. Resistance of EI-K control-unit plug and vehicle ground. Accelerator pedal in full-throttle position. Accelerator pedal in part-load position.</p>	8 B-	<p>Approx. 0 Ω (Continuity) infinity Ω (Open-circuit)</p>



TEST SPECIFICATIONS

Coolant temperature sensor	+ 20° C	2,1...2,9 k Ω
	+ 30° C	1,4...2,0 k Ω
	+ 80° C	280...370 Ω
	+ 90° C	210...280 Ω
	+100° C	160...215 Ω
<hr/>		
Knock-sensor tightening torque		15... 25 Nm
<hr/>		
Pulse generator – cylinder recognition		900...1600 Ω
<hr/>		
Transmission overload protection switch (does not close/open)		
Position "N" / "P"	Greater than 20 k Ω	
"D"	Less than 1 Ω	
with engine idling		
<hr/>		
Ignition coil, primary		0,2...0,4 Ω
<hr/>		
Ignition coil, secondary		7,2...13,2 k Ω
<hr/>		
Ignition-distributor setting		Cyl. 1 TDC ID mark
<hr/>		
EI-K control-unit voltage with ignition ON		Battery voltage
<hr/>		
Primary-circuit voltage with ignition ON		Battery voltage
<hr/>		
Pulse-generator insulation		infinity Ω
Internal resistance		
Pulse generator		680...1200 Ω
<hr/>		
Pulse-generator voltage at cranking speed		U s greater than 1 V
<hr/>		
Contact resistance		
Supply lines		
EI-K control unit or primary circuit		max. 0,3 Ω

K21

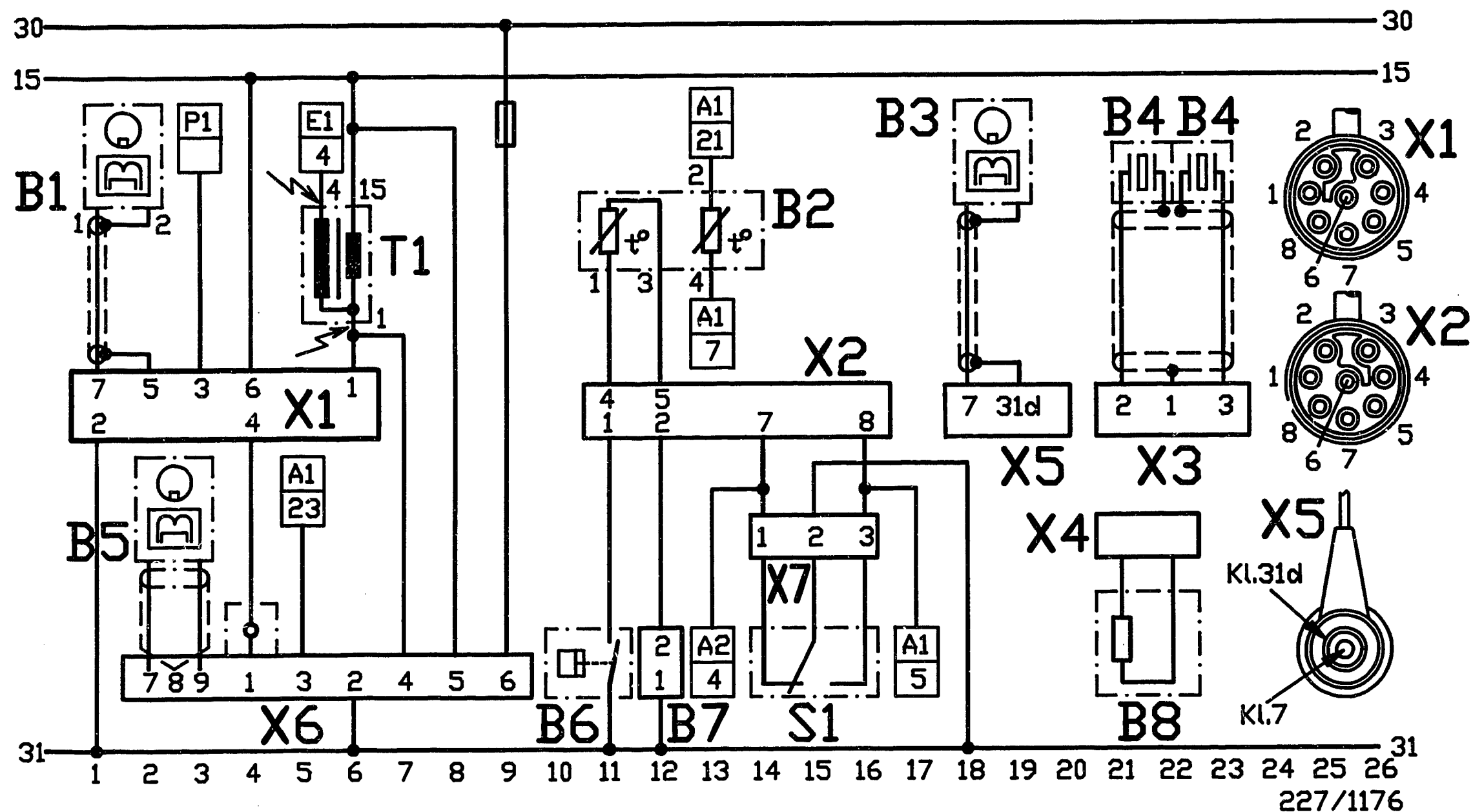


TEST SPECIFICATIONS (continued)

Primary signal at cranking speed	Primary voltage/ engine-speed display
<hr/>	
Peak-coil-current cutoff after approx. 1 s with ignition ON	0 V
<hr/>	
Voltage, EI-K control unit and ignition coil with engine idling	12...14 V max. 1 V below U _B
<hr/>	
Primary voltage with engine idling	200...290 V
<hr/>	
Spark-advance angle with engine idling	14°...18° BTDC
Engine at operating temperature, however less than 95° C	
<hr/>	
Throttle-valve switch, idle	
Acc. pedal in off-pos.	Approx. 0 Ω (Continuity)
Acc. pedal in part-load pos.	Infinity Ω (Open-circuit)
<hr/>	
Throttle-valve switch, full load	
Accelerator pedal in full-throttle position	Approx. 0 Ω (Continuity)
Accelerator pedal in part-load position	Infinity Ω (Open-circuit)
<hr/>	
Please refer to SIS microcard on Jetronic and/or Autodata test specifications for settings regarding idle speed, exhaust gas and valve clearance etc.	

K22



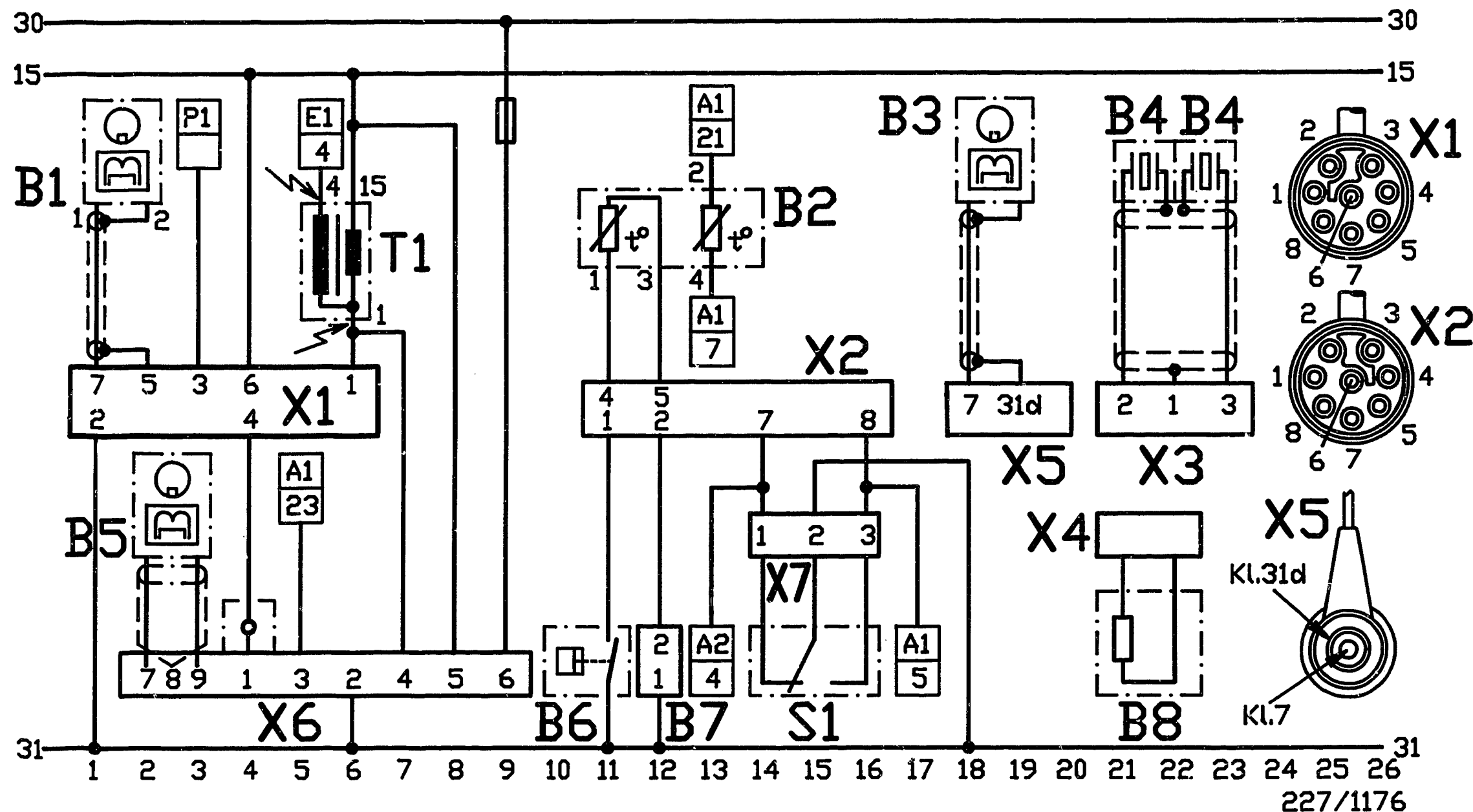


High-tension arrows: Caution 400 V...25 kV

A1 = KE-Jetronic control unit
 A2 = Control unit, idle-speed regulation
 B1 = Pulse generator - cylinder recognition
 B2 = Coolant temperature sensor
 B3 = Pulse generator
 B4 = Knock sensors
 B5 = TDC sensor

B6 = Transmission overload protection switch
 B7 = Instrument cluster (electron. speedometer)
 B8 = Trimming coupling
 E1 = Ignition distributor
 S1 = Idle/full load throttle-valve switch
 P1 = Diagnosis connection

ELECTRICAL TERMINAL DIAGRAM



High-tension arrows: Caution 400 V...25 kV

- X1 = EI-K control-unit plug (8 pole)
- X2 = EI-K control-unit plug (8 pole)
- X3 = EI-K control-unit plug, knock sensors (3 pole)
- X4 = EI-K control-unit plug, trimming coupling

- X5 = EI-K control-unit plug, pulse generator
- X6 = Diagnosis socket
- X7 = Plug connection, throttle-valve switch

ELECTRICAL TERMINAL DIAGRAM (continued)

INSTALLATION POSITION OF COMPONENTS

EI-K control unit:
at wheel house, front left.

KE-Jetronic control unit:
In passenger compartment, front right.

Control unit, idle-speed regulation:
In passenger compartment, front right,
beneath footrest.

Pulse generator:
At engine block, rear left.

Coolant temperature sensor:
Between ignition distributor and mixture-control unit.

Throttle-valve switch:
At throttle-valve assembly.

Transmission overload protection switch:
On left-hand side of transmission.

Knock sensors:
Behind left and right engine mounts.

Ground points:
Main ground (behind instrument cluster)
Wheel-house ground (front left at ignition coil)
Ground, front left (lighting unit)
Engine ground (lead screwed on)

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : MB-5041
BOSCH system : KE Jetronic 3.1
Make of vehicle : MERCEDES-BENZ
Basic microcard : PKW-014

TABLE OF CONTENTS

Section	Coordinates
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Test specifications.....	03
Rapid diagnosis chart.....	09
Electrical terminal diagram.....	21
Diagram of air pipes and fuel lines.....	25
Installation position of components, removal and installation instructions.....	26

SPECIAL FEATURES

* These instructions, valid at the time of publication, contain trouble-shooting instructions for the following model:

MERCEDES-BENZ

190 E 2.3 2,31/ 4-cyl. (US) 09.87->

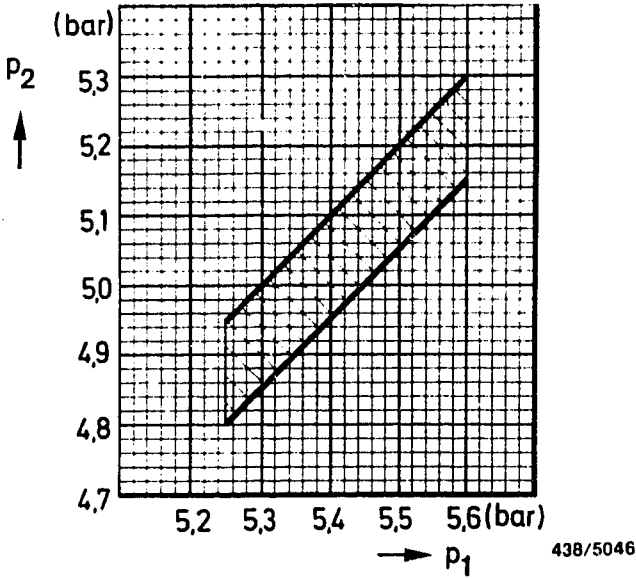
- * Trouble-shooting employing these instructions may only be performed if the data given in the "Overview of Service Information for Vehicles" (KFZ-0..) coincide with those of the vehicle type and the BOSCH number of the installed KE-Jetronic control unit.
- * Electronically controlled idle-speed regulation with single-winding rotary actuator, without bypass adjusting screw.
- * Active-carbon filter and regeneration valve for returning fuel vapors to intake manifold. (Fuel vaporization system)
- * Diagnosis lamp "CHECK ENGINE" lights up as a functional check when switching on the ignition. During engine operation, it indicates failure of the lambda sensor.

Important information:

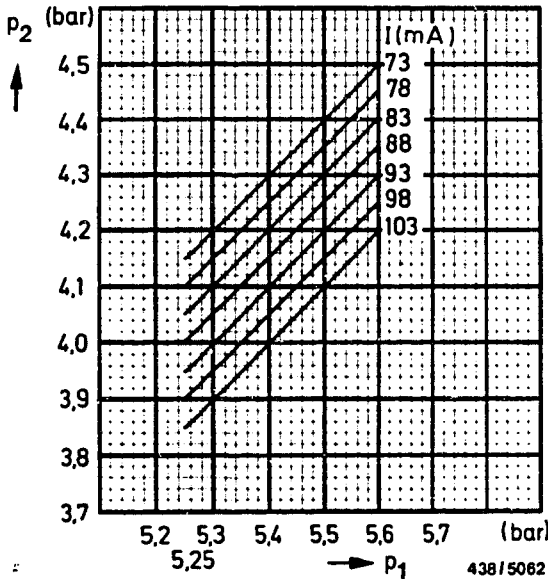
If reference is made to a basic microcard, the test specifications are always to be taken from the vehicle-specific brief instructions. Pay attention to safety and precautionary measures outlined in basic instructions, so as to avoid endangering people and to prevent damage to engine, trigger boxes, control units or ignition system.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1100 cm ³ /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. <u>Do not</u> switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA) Idle: Part load: Full load: Min. delivery at max. air-flow sensor plate defl.:	Setting point: (cm ³ /min) 6,0 40,0 100,0	Max. permis. delivery: (cm ³ /min) 6,6 42,5 109,0 140 cm ³ /min



p₁ = Primary pressure
p₂ = Lower-chamber pressure

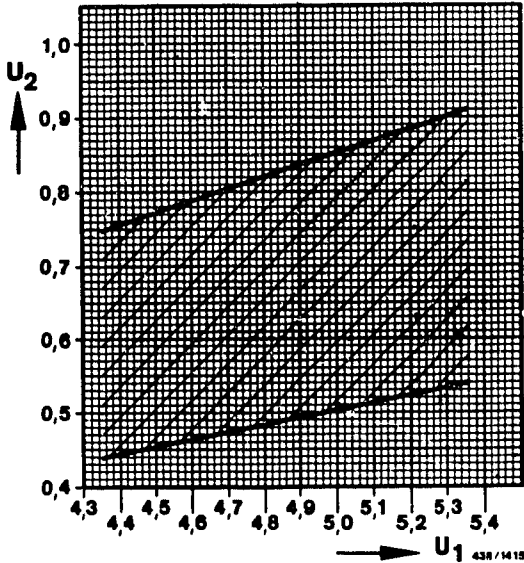


TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
7	Rate of flow, KE restriction:	130...150 cm ³ /min
8	Temperature sensor, air (NTC I): Air temperature +15...+30°C:	— k Ω
9	Temperature sensor, engine (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting: Fuel-distributor seat — needle bearing:	20,9...21,6 mm
11	Idle adjustment: Low-idle-speed control: adjustment of idle-air delivery not possible. For testing, engine at norm. op. temp. Idle speed: Engage driving position, speed: Engage driving position and switch on air conditioner, speed: Check lambda closed-loop control: Measurement with lambda closed-loop control tester (e.g. KDJE-P 600) and adapter lead (e.g. KDJE-P 600/52) at diagn. socket outlet (pin3) Alternatively: Current measurement using universal test adapter. Put fuel evaporation system out of operation. On/off ratio fluctuating, mean value: Adjustment at idle-mixture-adjusting screw.	 700...800 min ⁻¹ 620...720 min ⁻¹ > 600 min ⁻¹ 45...55 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	<p>Signal, air-flow sensor potentiometer:</p> <p>(Checking necessary when poor idle and/or part-load behavior)</p> <p>Measurement using test adapter and voltmeter.</p> <p>Determine supply voltage of potentiometer: Set value (test adapter, V-position 10):</p> <p>Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage:</p> <p>Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins).</p> <p>Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).</p>	<p>4,35...5,35 V</p> <p>See chart</p>



U 1 = Supply voltage
potentiometer

U 2 = Potentiometer
voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER
ETT 018.01 WITH KE3 ADAPTER LEAD
1 684 463 169 AND SUITABLE MULTIMETER:

The following rapid diagnosis chart makes it possible for experienced Jetronic specialists to rapidly check the electrical/electronic peripheral and control-unit functions of the KE-Jetronic including the lambda closed-loop control.

Important information regarding the following rapid diagnosis chart:

The "Test conditions" column indicates the test steps for which the control-unit plug must be connected/detached. Whenever the plug is connected or detached, care is to be taken to ensure that the system is deenergized, i.e. the ignition must be switched off and the electrical safety circuit must not be jumpered.

The "Test connections" column provides information on the connected leads in each measuring path referenced to the assignment in the control-unit plug. Any trouble-shooting measures which may be required relate to these leads.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V Ω Bt n	Under test	Test pins	Test conditions	Test specifications
1	 V 4 -	Internal resistance (R ₁) pressure actuator	12-10	Disconnect control-unit plug.	20... 30 Ω
2	 V 5 -	Resistance, temperature sensor (engine)	21- 2	Engine temperature +15...+30°C: approx. +80°C:	1,3...3,6 k Ω 250...390 Ω
3		Resistance, temperature sensor (intake air)		Air temperature in area of NTC I = +15...+30°C:	Test step not applicable
4	 V 6 -	Signal, altitude sensor	11- 2	Connect control unit. Switch on ignition. Voltmeter connection to blue Ω -sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	3,2...4,5 V 2,8...4,0 V 2,4...3,5 V 2,0...3,0 V 1,6...2,5 V 0,8...1,6 V
5	 V 9 -	Throttle-valve switch, idle	13- 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0... 10 Ω > 1000 Ω
6	 V 10 -	Throttle-valve switch, full load	5- 2	Throttle valve closed: fully open:	> 5000 Ω 0... 10 Ω
7	 V 11 -	Microswitch idle linkage	24- 2	Throttle valve closed: open:	0... 10 Ω infinite Ω
8	 V 12 -	Ground, control unit	20- 2		0... 10 Ω
9	 V 13 -	Ground, pin 7	7- 2	Switch off ignition. Connect control unit.	0... 10 Ω

Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

No.	Switch/Btn			Under test	Test pins	Test conditions	Test specifications
	V	Ω	Bt n				
10	I V	14	-	Trimming plug Mixture map	22- 2	Disconnect control-unit plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) to engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	- Ω - Ω - Ω - Ω - Ω - Ω - Ω
11	I V	15	-	Transmission switch (only automatic transmission)	16- 2	Connect air-flow sensor potentiometer. Selection lever position P, N: Driving position selected:	0... 10 Ω infinite Ω
12	5	-	-	TD signal	25- 2	Start engine (starting motor):	Voltage undefined
13	6	-	-	Control-unit supply	1- 2	Switch on ignition:	8... 15 V
14	7	-	-	Idle actuator supply and continuity	3- 2	Switch on ignition:	8... 15 V
15	8	-	-	Tempomat signal	6- 2	Switch Tempomat operation:	- V
16	9	-	-	Air-conditioner cut-in signal	19- 2	Switch off ignition. Connect control unit. Start engine, switch on air conditioner. Temperature regulator = Minimum temperature	8... 15 V
17	10	-	-	Supply, air-flow sensor potentiometer	18- 2	Switch on ignition:	4,35...5,35 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/ V	Btn Ω	Under test	Test pins	Test conditions	Test specifications
18	11	-	-	Signal, air-flow sensor potentiometer	17- 2 Switch on ignition. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous rise up to max.:	0 V 5,35 V
19	13	-	1	Temperature signal from control unit	9- 2 Switch on ignition. While actuating btn 1:	1,5...1,9 V
20	14	-	-	Consumption signal	4- 2 Start engine - idle: With regulation:	Voltage undefined Voltage change
21	-	-	-	Peak coil current	12-12 Switch on ignition:	->FD — : — mA FD 746->: 18...22 mA
22	-	21	1	Warm-up enrichment + 20° C	12-12 Warm up engine - idle. Current value with btn 1 pressed:	->FD — : — mA FD 746->: 4... 8 mA
23	-	24	2	Actuator current engine at normal operating temperature	12-12 Engine at normal operating temperature, idle. Current value with btn 2 pressed; reading oscillating, mean value:	->FD — : — mA FD 746->: -1...+1 mA
24	-	21	2	Starting enrichment	12-12 So that engine fails to start: Disconnect speed relay for electric fuel pump. Short circuit ignition coil term.4 to ground via resistance of at least 2k Ω . (e.g. with sleeve-type suppressor and spark gap) While btn 2 pressed, actuate starting motor. Current rise (max. 1 sec.) to:	->FD — : — mA FD 746->: 40...60 mA

FD = Date of manufacture

L15 — <==>

L16 — <==>

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

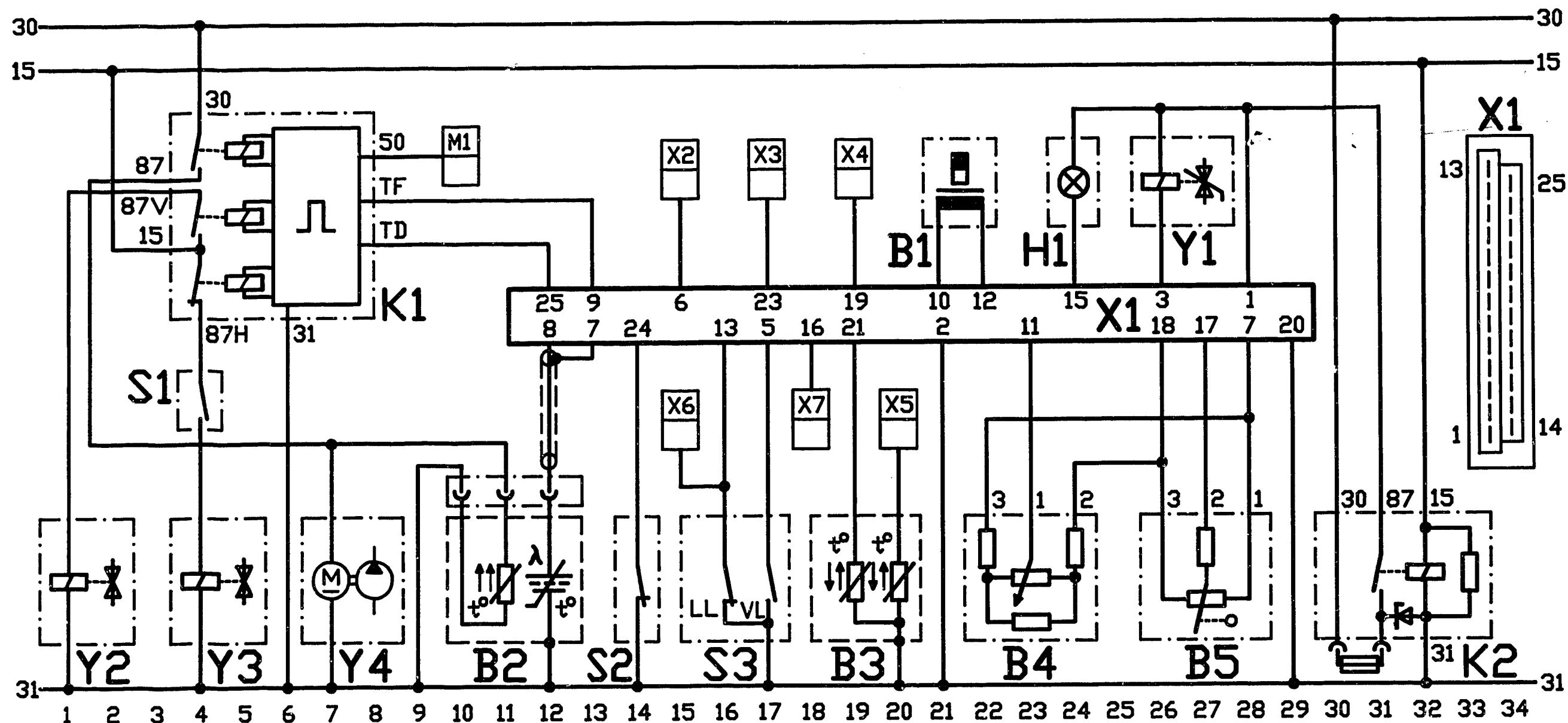
No.	Switch/ V	Btn Ω	Under test	Test pins	Test conditions	Test specification CAT
28	-	24	-	Full-load enrichment	12-12 Engine at normal operating temperature, idle. Reading oscillating, mean value: Briefly push accelerator pedal to floor (full-load throttle-valve switch must switch). During speed rise, current value rises by: A t t e n t i o n: Do this very briefly, so that speed does not rise too much and engine is not damaged.	->FD —: — mA FD 746 ->: -1...+1 mA ->FD —: — mA FD 746 ->: 2...6 mA
29	-	21	-	Lambda closed-loop control, open-loop control mode	12-12 Disconnect regeneration lead to throttle-valve assembly at generation valve and seal. Engine at norm. op. temp., idle. Current value:	-1...+1 mA
30	-	24	-	Lambda closed-loop control, closed-loop control mode	12-12 Engine at norm. op. temp., idle. Closed-loop control mode can be recognized from the oscillating current reading. Mean value: If mean value outside tolerance, set (idle-mixture-adjusting screw) to approx.:	-1...+1 mA 0 mA
31	-	22	-	Lambda closed-loop control, rich stop	12-12 Engine at norm. op. temp., idle. Current rise to:	8... 12 mA
32	-	23	-	Lambda closed-loop control, lean stop	12-12 Engine at norm. op. temp., idle. Current drop to:	-8...-12 mA

*) FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/ V	Btn Ω	Under test	Test pins	Test conditions	Test specifications
25	—	21	1	Post-start enrichment	12-12 Start engine (at normal operating temperature) while actuating btn 1. Current value: Current value constant for a few seconds, then slow speed regulation.	->FD — : — mA FD 746->: 14...18 mA
26	—	21	1	Acceleration enrichment	12-12 Engine at normal operating temperature, idle. While actuating btn 1, perform snap acceleration of engine. Thus current rise (approx. 1 sec.) to: Note: Level of current value dependent upon intensity of acceleration (travel/duration of air-flow sensor plate movement).	->FD — : — mA FD 746->: 20...50 mA
27	—	—	—	Overrun cut-off	12-12 Re-connect ohmmeter (swap positive and negative). Start engine (normal operating temperature). Drive vehicle on chassis dynamometer or road. Increase speed n briefly to at least approx.: Current reading during falling speed phase: (idle throttle-valve switch closed)	->FD — : — min ⁻¹ FD 746->: 2000 min ⁻¹ -40...-80 mA

FD = Date of manufacture

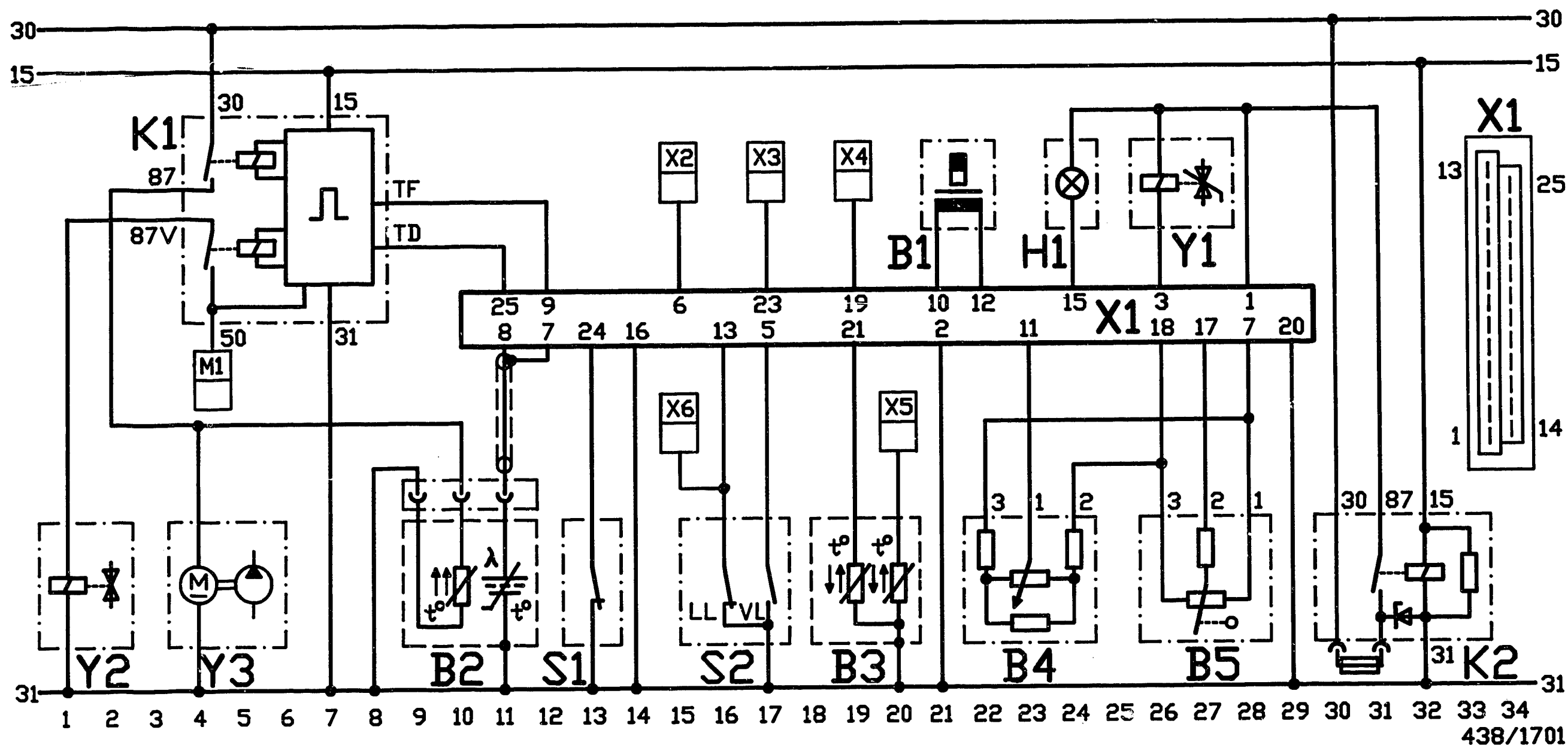


438/1702

B1 = Pressure actuator
 B2 = Lambda sensor
 B3 = Temperature sensor (engine)
 B4 = Altitude sensor
 B5 = Air-flow sensor potentiometer
 H1 = Diagnosis lamp (CHECK ENGINE)
 K1 = Electric fuel pump relay
 K2 = Over-voltage protection relay
 M1 = Connection, starting motor, terminal 50
 S1 = Microswitch, overrun cut-off
 S2 = Throttle-valve switches (full load, idle)

X1 = Plug, KE control unit
 X2 = Speed signal
 X3 = Connection, diagnosis socket, pin 3
 X4 = To air conditioner
 X5 = To ignition trigger box, terminal 1
 X6 = To ignition trigger box, terminal 2
 Y1 = Idle actuator
 Y2 = Start valve
 Y3 = Electric fuel pump

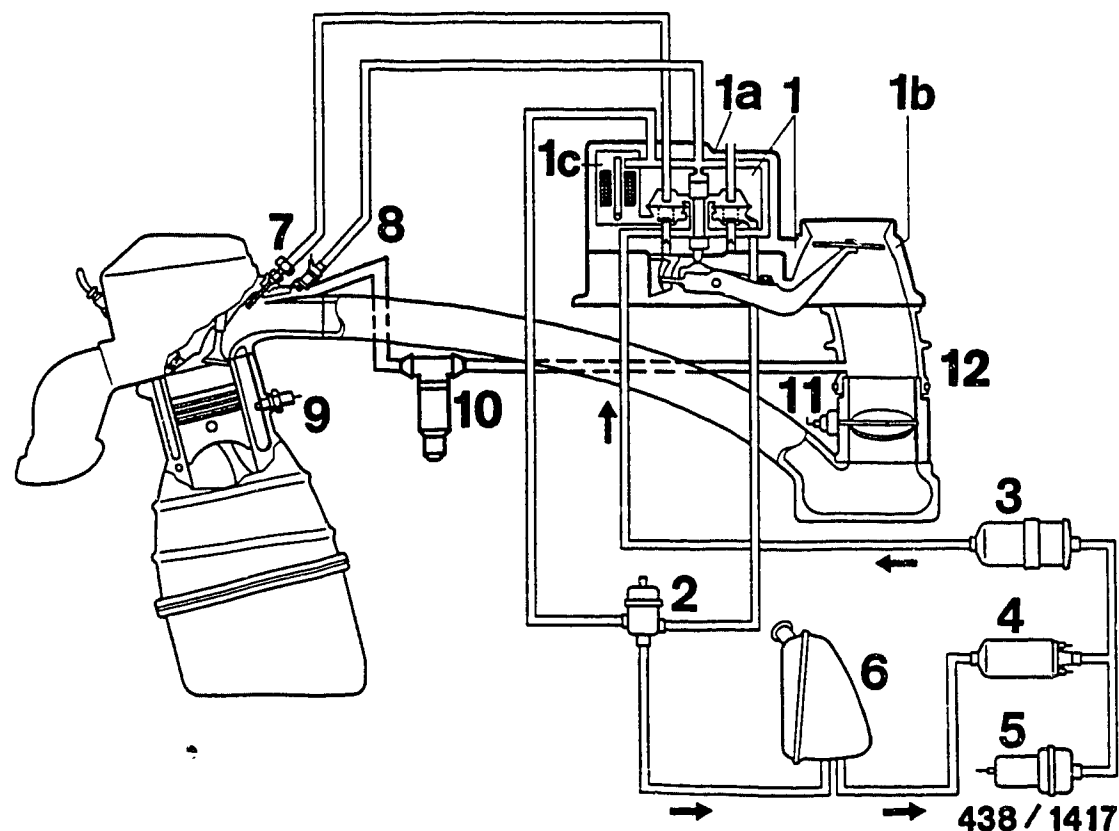
ELECTRICAL TERMINAL DIAGRAM (manual transmission)



B1 = Pressure actuator
 B2 = Lambda sensor
 B3 = Temperature sensor (engine)
 B4 = Altitude sensor
 B5 = Air-flow-sensor potentiometer
 H1 = Diagnosis lamp (CHECK ENGINE)
 K1 = Electric fuel pump relay
 K2 = Over-voltage protection relay
 M1 = Connection, starting motor, terminal 50
 S1 = Kickdown switch
 S2 = Microswitch, overrun cut-off
 S3 = Throttle-valve switches (full load, idle)

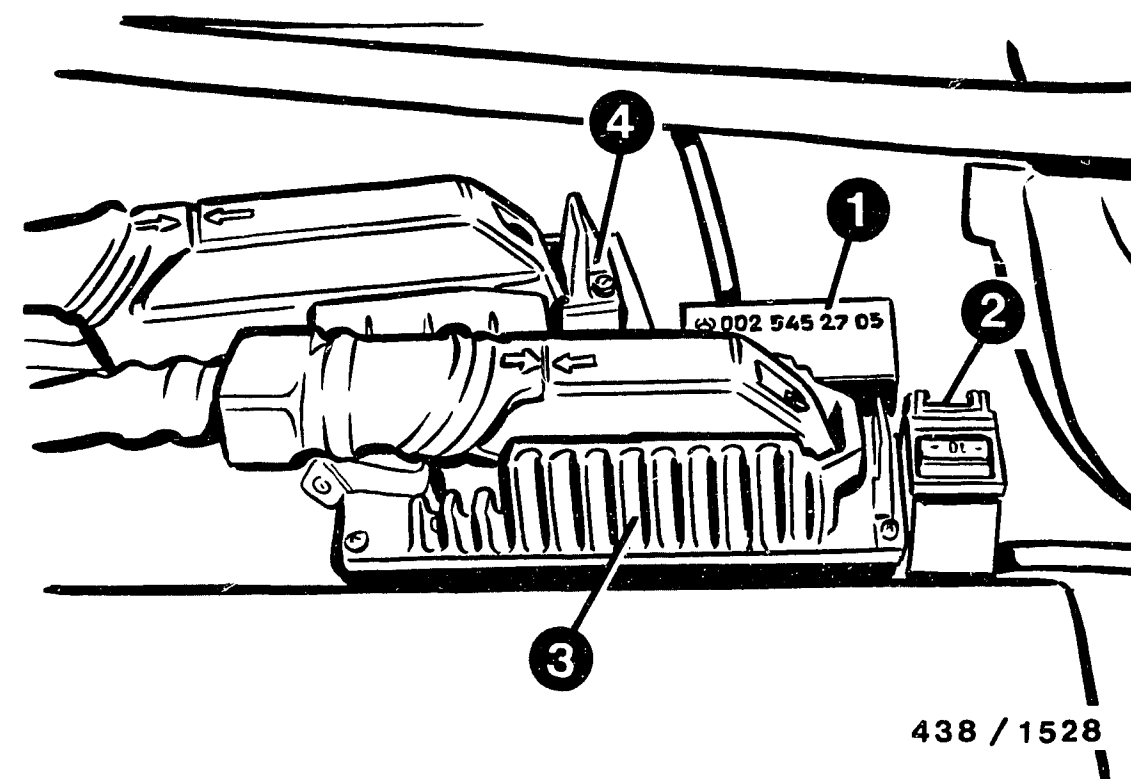
X1 = Plug, KE control unit
 X2 = Speed signal
 X3 = Connection, diagnosis socket, pin 3
 X4 = To air conditioner
 X5 = To ignition trigger box, terminal 1
 X6 = To ignition trigger box, terminal 2
 X7 = To gear-shift switch
 Y1 = Idle actuator
 Y2 = Start valve
 Y3 = Change-over valve
 Y4 = Electric fuel pump

ELECTRICAL TERMINAL DIAGRAM (automatic transmission)



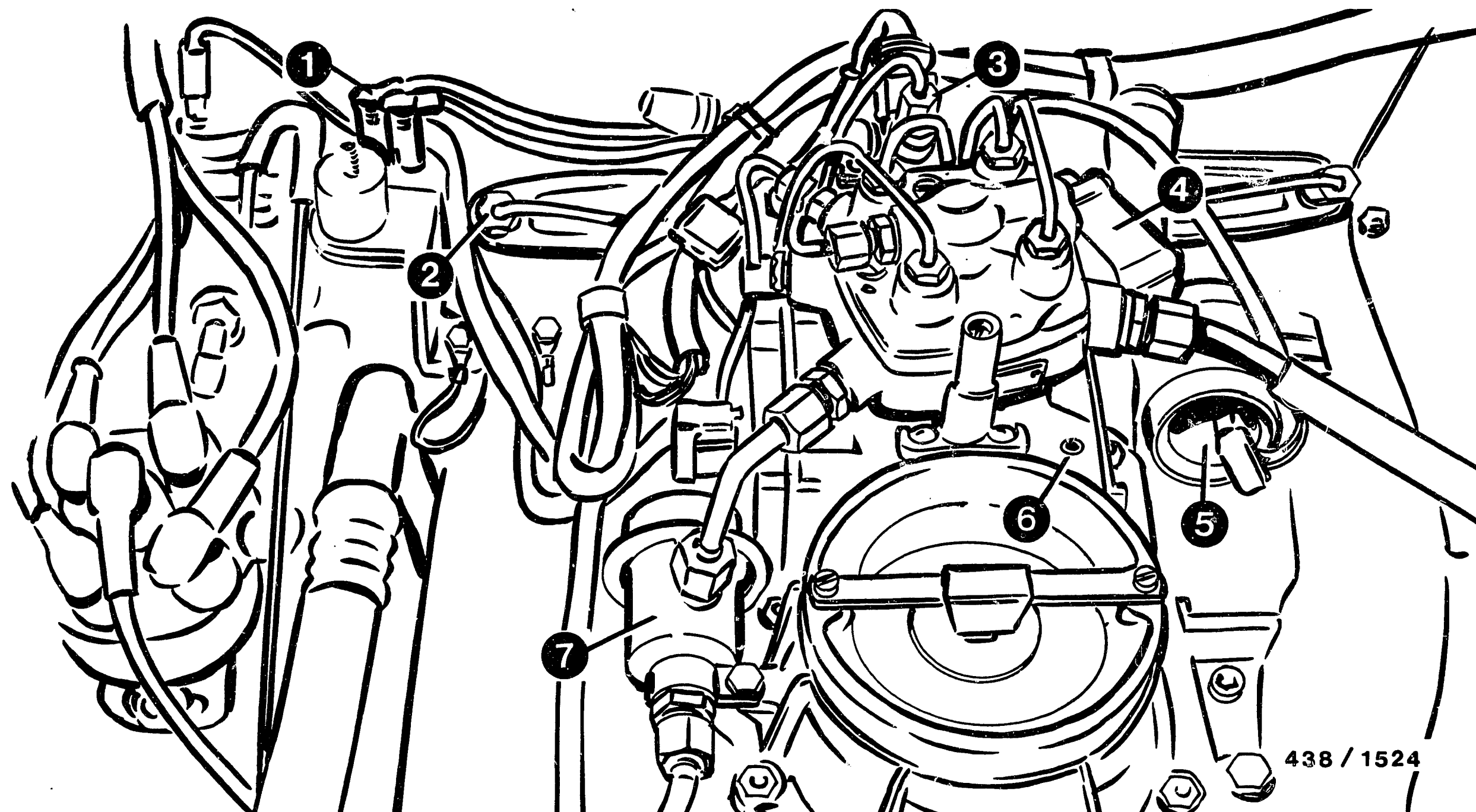
- 1 = Mixture-control unit
- 1a = Fuel distributor
- 1b = Air-flow sensor
- 1c = Electro-hydraulic pressure actuator
- 2 = Pressure regulator, primary pressure
- 3 = Fuel filter
- 4 = Electric fuel pump
- 5 = Fuel accumulator
- 6 = Fuel tank
- 7 = Injection valve
- 8 = Cold-start valve
- 9 = Temperature sensor engine (Double NTC)
- 10 = Idle actuator
- 11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



- 1 = Electronic relay for electric fuel pump and cold-start valve actuation
- 2 = Over-voltage protection relay
- 3 = KE-Jetronic control unit
- 4 = ABS controller (if present)

INSTALLATION POSITION OF COMPONENTS



438 / 1524

1 = Engine temperature sensor
2 = Injection valves
3 = Cold-start valve

4 = Pressure actuator
5 = Idle actuator

6 = Mixture-control unit
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

Trouble-shooting instructions : ALF-5009
BOSCH system : Motronic ML 4.1
Make of vehicle : ALFA ROMEO
Basic microcard : KFZ-00..

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Trouble-shooting chart	06
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Installation position of components, notes on removal and installation	23

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

ALFA ROMEO 164 3.0 V6 as of 09.87
with 3.0 l / V6 engine
136 kW with cat.
140 kW with no cat.

- * Motronic ML 4.1 with self-diagnosis.
Note: The self-diagnosis contains actuator diagnosis (refer to basic instructions).
- * Variant encoding for octane-number adaptation (term.10) and "Country variant" (with/without cat.; term.27).
Refer to basic instructions.
- * The fault memory can be read out with the pocket system tester KTS 300 (0 684 400 300) with program module PPG 204 as of status 09.1989 (only possible on more recent vehicles).
Note:
Further diagnosis possibilities (such as actuator diagnosis), which would be possible with later program-module statuses, are not evaluated with these vehicles.
Pay attention to operating instructions for KTS 300.
Connect up KTS 300 by way of universal adapter lead of tester to diagnosis connection in vehicle (refer to next page).
- * As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (refer to basic instructions).
- * The self-diagnosis test table takes account of both the KTS 300 and the flashing code, and is arranged according to fault-code numbers indicated by the KTS 300.
The fault-indication column sometimes contains two types of fault optionally indicated by the tester, e.g.:
Open circuit/short to ground (= 1st type of fault)
Short to positive (= 2nd type of fault)

SPECIAL FEATURES (continued)

How to use self-diagnosis

The latest Alfa models with Motronic feature a connection for tester diagnosis (3-pole connector at Motronic wiring harness, in vicinity of control unit). Refer to top picture. The connection (4-pole) for the evaluation unit KDAW 9980 (flashing code) is now likewise located in the passenger compartment in the vicinity of the control unit and not in the engine compartment (refer to basic microcard).

1. TESTER DIAGNOSIS

Connect pocket system tester KTS 300 by way of universal adapter lead (4 banana plugs) as follows:

Lead with yellow coding to term. 1 in 3-pole plug.

Lead with green coding to term. 3 in 3-pole plug.

Black lead to term. 1 in 4-pole plug (ground).

Red lead to term. 2 in 4-pole plug (switched positive).

See pictures.

2. FLASHING CODE DIAGNOSIS

Connect evaluation unit KDAW 9980 as follows:

Button of evaluation unit (sockets 3 and 4) between term. 1 (ground) and term. 4 (stimulation input) in 4-pole plug.

Connect socket 2 of evaluation unit to term. 3 (lamp output stage) and socket 1 (red) to term. 2 (switched positive) or battery positive.

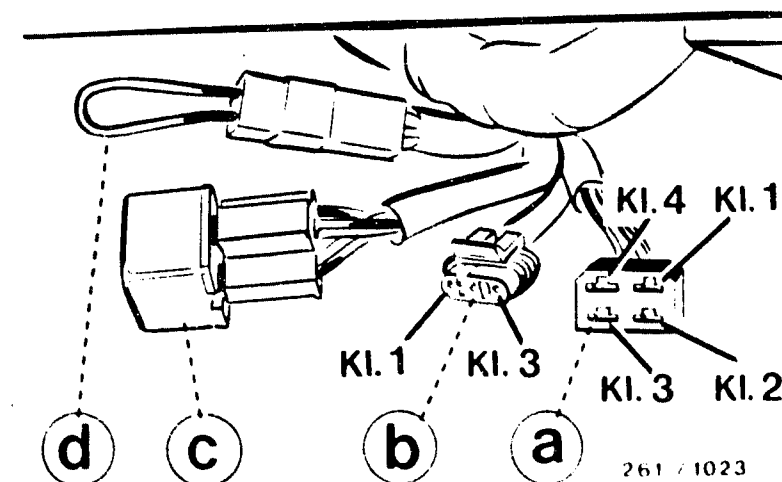
Refer to top picture.

Note:

If fault lamp installed in vehicle (currently only US version), do not connect sockets 1 and 2 of evaluation unit and follow flashing code output by way of built-in fault lamp.

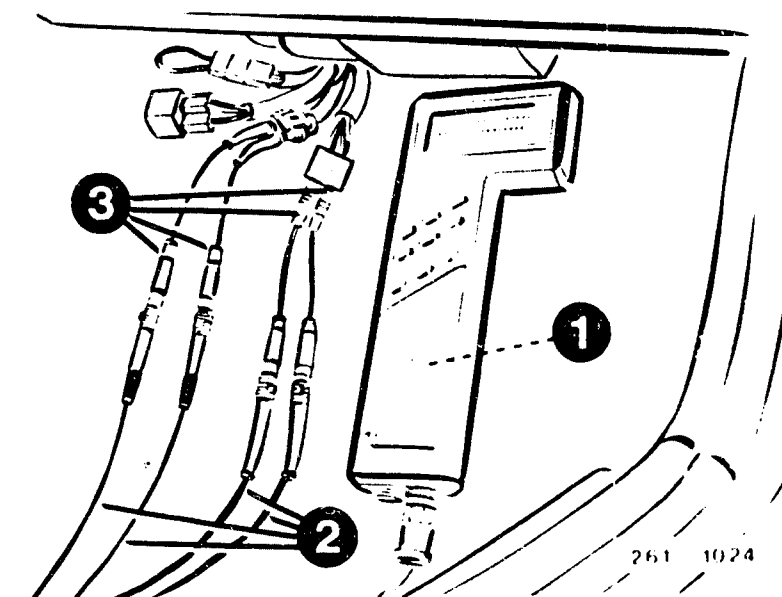
N o t e :

For connection of tester or evaluation unit, make use of suitable adapter cables from set of test cables (No. 1 687 011 208).



- a = 4-pole plug
- b = 3-pole plug
- c = Encoding section (relay housing)
- d = Wire jumper (permanent encoding for bodywork version)

- 1 = Pocket system tester KTS 300
- 2 = Universal adapter lead for KTS 300
- 3 = Adapter leads from set of test cables



SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/Test conditions	Termi- nals	Set values
Data exchange not possible	—	—	Prerequisite for fault output: leads between control unit and diagnosis socket/fault lamp (flashing code) as well as voltage supply for control unit O.K. Note: Fault lamp is currently only installed in US models in instrument panel (CARB lamp).	04 12 17	—
Control unit Digital sec.(comput) defective	01	1251	Control unit defective.	—	—
Relay Fuel pump Op.circ/Ground short Short to B+	03	1243	Fault 1: Open-circuit (Op.circ) or short to ground (ground short). Fault 1 is only detected if other output stages are defective. Fault 2: Short-circuit to positive (short to B+). Detach pump relay and measure voltage (with respect to ground) in frame (term. 86) with ignition switched on: Resistance of relay coil (term. 85/86): Check lead to control unit (term. 20).	20	10....15 V approx. 50...150 Ω
Idle actuator ZWD Winding 1/EWD Op.circ/Ground short Short to B+	04	1222	Check leads and plug connection of actuator for open-circuit (op.circ), short-circuit to ground (ground short) and short-circuit to positive (short to B+). Winding resistance at +15...+30°C:	33	approx. 8 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/Test conditions	Termi- nals	Set values
Air-flow sensor/ Air-mass sensor Signal too low Signal too high	07	1221	Signal too low: check lead to air-flow sensor term. 2 (signal) and term. 3 (approx. +5 V) for open-circuit and short-circuit to ground. Signal too high: check lead to air-flow sensor term. 2 for short-circuit to positive (+5V or +12V) and ground lead (term. 4) for open-circuit. Check resistances at air-flow sensor: between term. 2 and term. 4 (deflect sensor flap): between term. 3 and term. 4: Measure wiper voltage at term. 2 with plug connected and ignition switched on (sensor flap in off-position): Slowly deflect sensor flap as far as full load:	07(S)* 09(+) 06(-)	 8...2500 Ω 300... 550 Ω 0,1...0,3 V greater than 4,2 V
Lambda control outside min. range outside max. range	10	1223	Note: Fault code 10 applies only for cat. models. Check CO content (ahead of catalytic converter). Check intake system and exhaust system for leaks. Incorrect fuel pressure. Sensor defective. Injection valve(s) clogged or not functioning. Important: Check Motronic ground connections at engine and/or bodywork (including ground strap between engine and bodywork) for contact resistances and open-circuits. Voltage supply of control unit must also be in perfect working order.	—	—
Fault lamp Op.circ/Ground short Short to B+	15	1265	Note: Fault lamp is currently only installed in US models in instrument panel (CARB lamp). Check lead to fault lamp for short-circuit to ground (ground short) and short-circuit to positive (short to B+). Open-circuit (op.circ) is not detected!	17	—

*) S = Signal

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions / Test conditions	Termin- als	Set values
Lambda sensor Open circuit Short to ground Short to B+	28	1224	Note: Fault code 28 applies only to cat. models. Check lead for open circuit, short to ground and short to B+. Watch out for worn insulation! Sensor heating defective. Sensor clogged.	24	—
Valve Tank ventilation Op.circ/Ground short Short to B+	34	1244	Note: Only CAT models have a tank ventilation valve. Check lead for contact with ground or positive. Valve winding resistance at +15...+30°C: If lead and valve ok, control unit is defective. Check lead for open circuit (op. circ).	34	approx. 30 Ω
Battery voltage too low too high	37	1211	Supply voltage for control unit too low: Check voltage dips at positive and ground terminal. Charge battery. Supply voltage for control unit too high: Check alternator regulator.	18(+)* 35(+) 05(-)	gr. than 10 V (with engine running) less than 16 V (with engine running)
CO potentiometer Signal too low Signal too high	43	1215	Note: CO potentiometer is only active in the case of models with no Lambda control. Signal too low: Check lead to air-flow sensor term. 1 for open circuit and short to ground. Signal too high: Check same lead for short circuit to live lead. Check potentiometer (and CO). To do so, measure voltage at air-flow sensor term. 1 with ignition switched on:	30	 0.8...4.5 V

*) = Continuous positive for fault memory and adaption.

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/Test conditions	Termi- nals	Set values
Air-temp. sensor Op. circ./sh. to B+ Short to ground	44	1225	Check temperature sensor and lead for open-circuit (op. circ.), short to ground and short-circuit to positive (short to B+). Temperature-sensor resistance at +15...+30°C:	22	1450...3300 Ω
Engine temp. sensor Op. circ./sh. to B+ Short to ground	45	1214	Check temperature sensor and lead for open-circuit (op. circ.), short to ground and short-circuit to positive (short to B+). Temperature-sensor resistance at +15...+30°C: at approx. +80°C:	13	1450...3300 Ω 280... 360 Ω
Idle switch Short to ground	52	1212	Fault: Idle contact (in throttle-valve switch) permanently closed or short to ground in lead. Idle contact closed in off-position: Actuate throttle valve somewhat:	02	approx. 0 Ω infinity Ω
Full-load switch Short to ground	53	1213	Fault: Full-load contact (in throttle-valve switch) permanently closed or short to ground in lead. Full-load contact closed in full-throttle position: Release accelerator pedal somewhat:	03	approx. 0 Ω infinity Ω
No fault stored	—	4444 or 1444	Continue trouble-shooting with trouble-shooting chart.	—	—
—	—	0000 or 1000	End of output (flashing code only)	—	—

TEST SPECIFICATIONS

Pressure regulator

* Fuel pressure 2,8...3,2 bar

Electric fuel pump

* Delivery
(measured in return line) min. 900 cm³ /30s
Supply voltage
(under load): min. 12 V

Temperature sensor (intake air)

* Internal resistance
measured at air-flow sensor
between term. 4 and term. 5
at ambient temperature
(+15°C...+30°C): 1450...3300 Ω

Temperature sensor (engine),
plug color, blue.

* Internal resistance
at ambient temperature
(+ 15° C...+ 30° C): 1450...3300 Ω
engine at operating temperature
(approx. + 80° C): 280....360 Ω

Solenoid-operated injection valve

* Internal resistance
at ambient temperature
(+ 15° C...+ 30° C): 15...17,5 Ω

Air-flow sensor

* Internal resistance between:
term. 2 and term. 4 : 8...2500 Ω (1)
term. 3 and term. 4 : 300...550 Ω
term. 1 and term. 4 (CO potentiometer):
Minimum 0...30 Ω
Maximum: the actual value measured between
term. 3 and term.4 may be up to
30 Ω less.

(1) Slowly deflect air-flow sensor flap as far
as it will go.
Fluctuating increase in resistance; slight
decrease towards end.

M15

TEST SPECIFICATIONS (continued)

Engine-speed sensor and reference-mark sensor

* Internal resistance
at ambient temperature
(+15°C...+30°C): 400...800 Ω
* Air gap: 0,8 ±0,5 mm

Throttle-valve switch

* Resistance of idle contact
(term. 2 and term. 18): approx. 0 Ω
* Resistance of full-load
contact (term. 3 and term. 18): approx. 0 Ω

Idle actuator

* Internal resistance
at +15°...+30°C : approx. 8 Ω

Lambda sensor

* Resistance of heater winding: 1...15 Ω

Tank-ventilation switching valve
(not from Bosch)

* Internal resistance: approx. 30 Ω

Ignition coil

* Primary resistance: approx. 1 Ω
* Secondary resistance: 5000...7200 Ω

M16

TEST SPECIFICATIONS (continued)

Idle test
(engine at operating temperature,
switch off loads).

- * Idle speed:
 - without catalytic converter: 650...750 min⁻¹
 - with catalytic converter: 650...800 min⁻¹ +)
- * Spark-advance angle: 2... 12 ° CS +)

Automatic transmission set to N or P

- * CO content:
 - without catalytic converter: 0,5...1,1 vol.% CO +)

Perform mixture adjustment
at CO potentiometer in air-
flow sensor:
Counter-clockwise = leaner mixture,
clockwise = mixture enrichment.

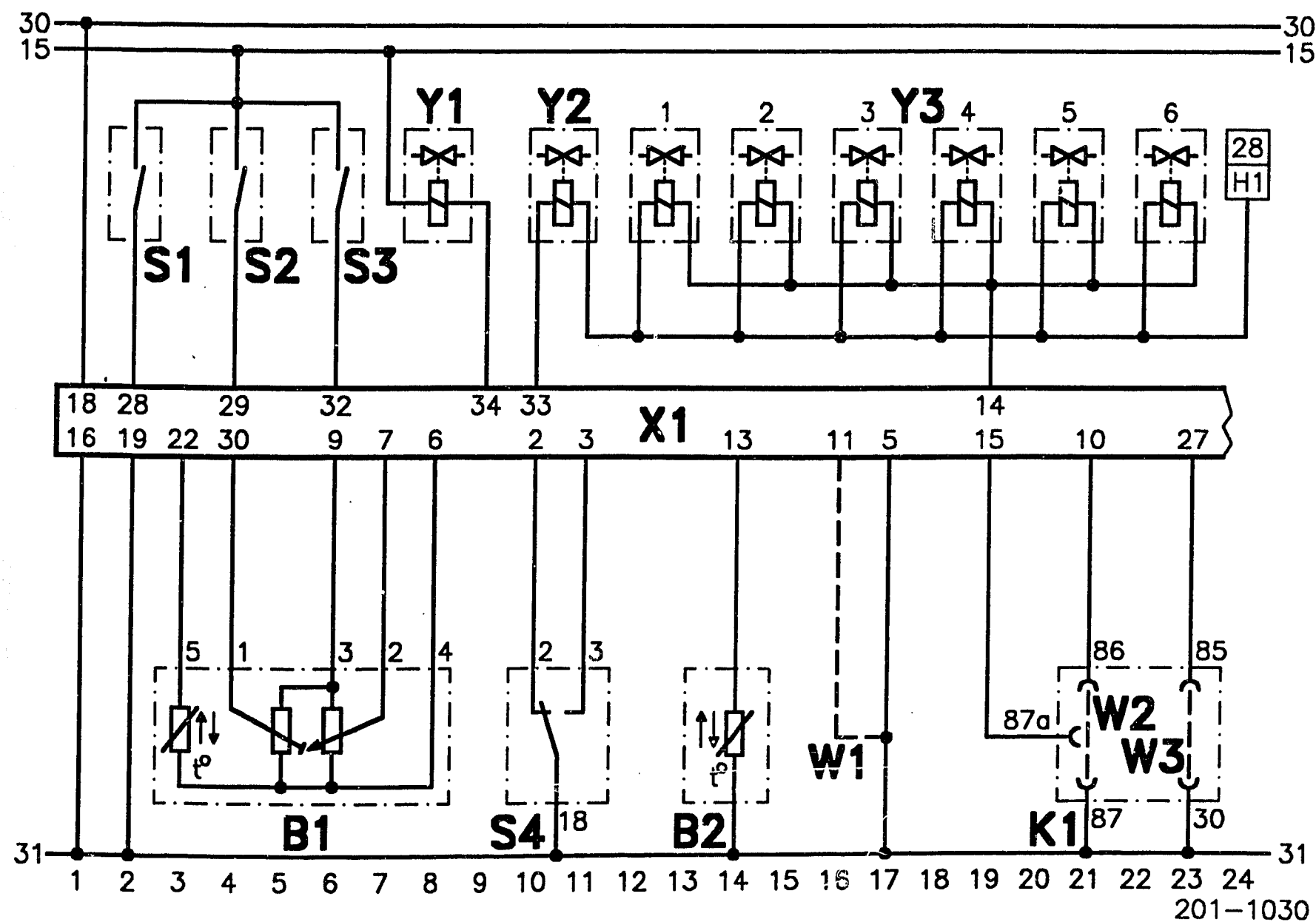
The potentiometer can be used
to adjust the injection time by
a maximum of 0.6 ms.

- * Vehicles with catalytic converter:
 - ahead of catalytic converter 0,4...1,0 vol.% CO
 - downstream of catalytic converter approx. 0 vol.% CO
(max. 0.2 %)

For production reasons:
continued on the following
coordinate.

+) Important! Variant coding may lead
to a deviation in the
stated basic values.
Pay attention to basic microcard!

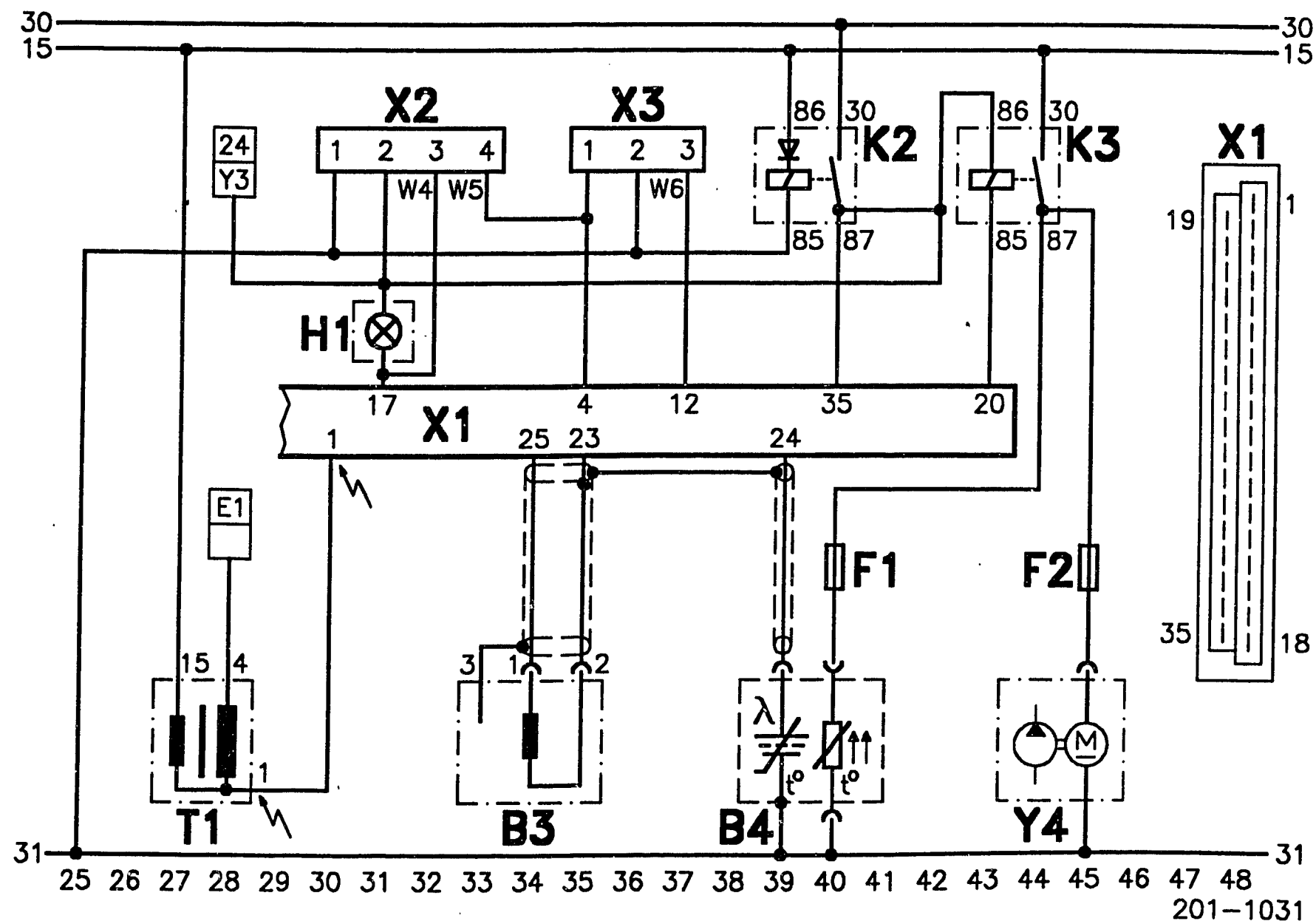
Please refer to equipment and Autodata
microcard for valve-clearance settings and
other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

B1= Air-flow sensor with CO potentiometer
 (CO pot. not active with cat. model)
 B2= Engine temperature sensor
 H1= Fault lamp (CARB; USA only)
 K1= Encoding section (relay housing)
 S1= Driving-position switch with autom. transmission
 S2= A/C readiness switch
 S3= A/C compressor switch
 S4= Throttle-valve switch

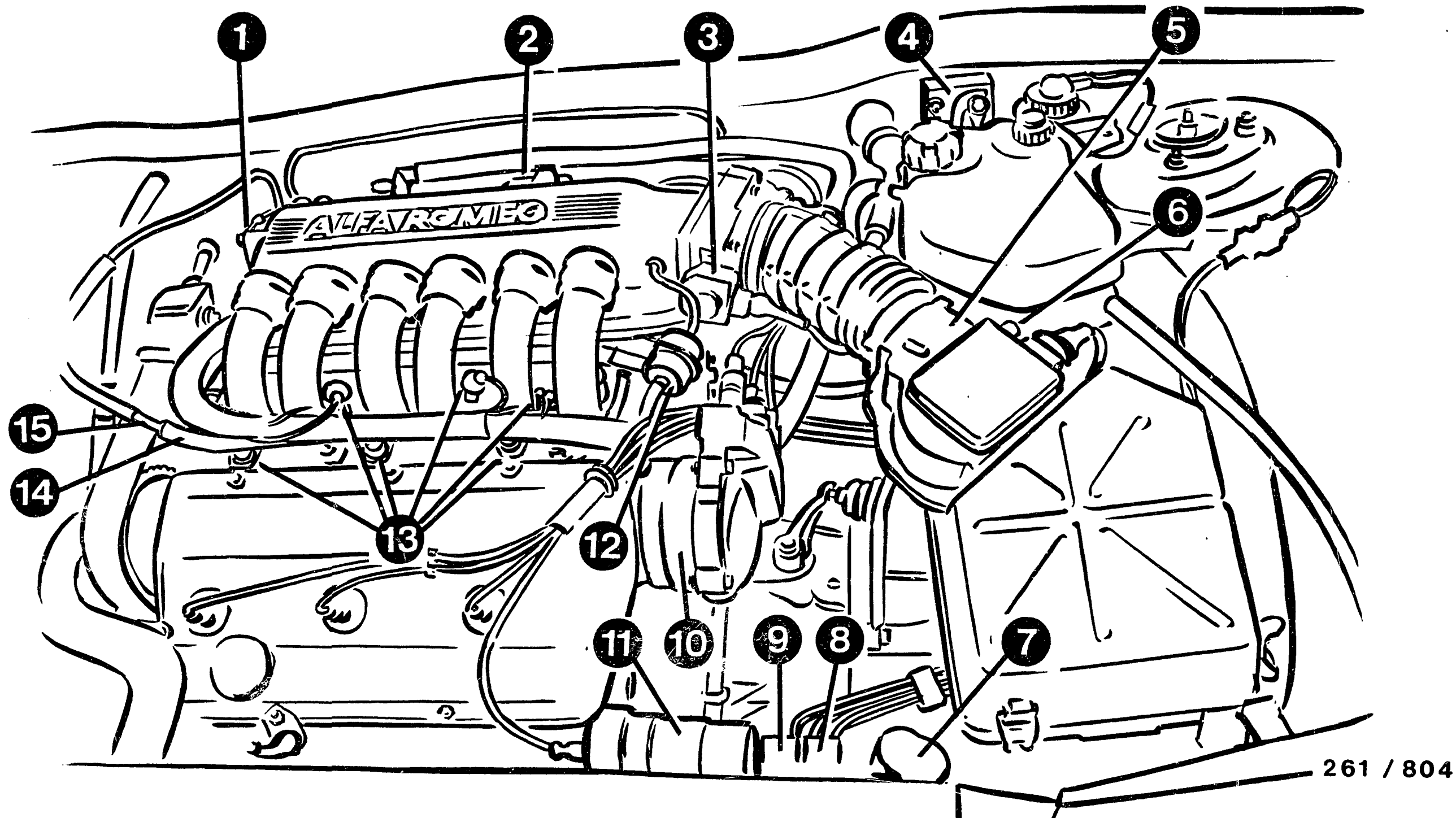
W1= Permanent encoding for bodywork variant
 (Alfa 75 / Alfa 164)
 W2= Encoding link for fuel variant
 W3= Encoding link for cat./no cat.
 X1= Control-unit plug (35-pole)
 Y1= Tank-ventilation switching valve
 (TES; not from Bosch)
 Y2= Idle actuator (EWD)
 Y3= Solenoid-operated injection valves



ELECTRICAL TERMINAL DIAGRAM (Continued)

B3= Engine-speed/reference-mark sensor
 B4= Heated Lambda sensor
 E1= H.T. distributor
 F1= Sensor-heating fuse
 F2= Fuel-pump fuse
 H1= Fault lamp (CARB; USA only)
 K2= Main relay
 K3= Pump relay
 T1= Ignition coil

W4= Fault-lamp output stage
 W5= Stimulation lead
 W6= Serial interface
 X1= Control-unit plug (35-pole)
 X2= 4-pole diagnosis connection (flashing code)
 X3= 3-pole diagnosis connection (tester)
 Y3= Solenoid-operated injection valves
 Y4= Electric fuel pump



1 = Motronic ground terminals
 2 = Idle actuator (EWD)
 3 = Throttle-valve switch
 4 = Battery terminal
 5 = Air-flow sensor
 6 = CO adjusting screw
 (potentiometer)

7 = Self-diagnosis socket
 (old version)
 8 = Main relay
 9 = Pump relay
 10 = H.T. distributor
 11 = Ignition coil
 12 = Fuel-pressure regulator

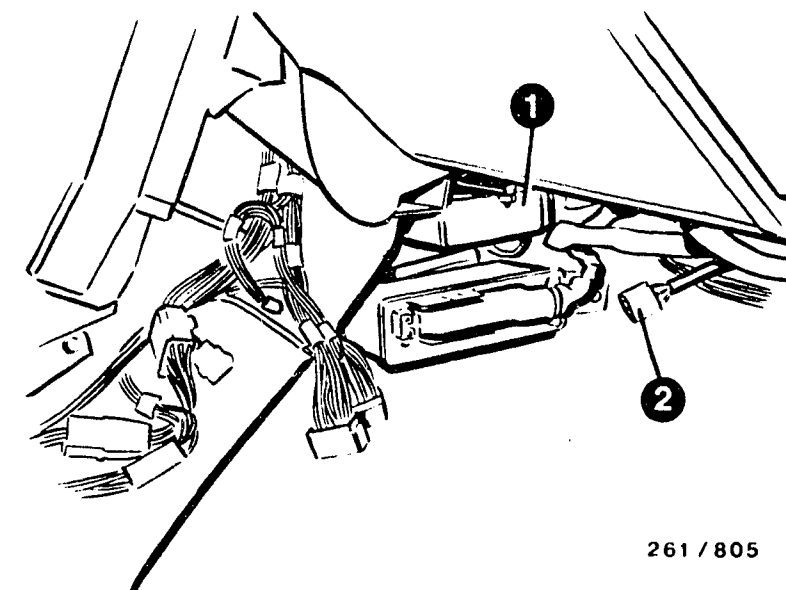
13 = Solenoid-operated injection valves
 14 = Fuel-distribution pipe
 15 = Measurement location
 for fuel pressure
 (fuel inlet)

INSTALLATION POSITION OF COMPONENTS

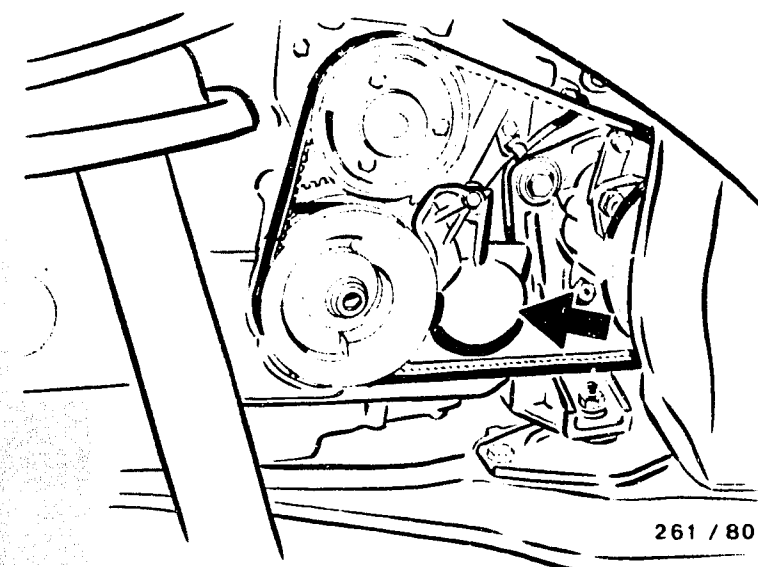
INSTALLATION POSITION OF COMPONENTS (continued)

The information given on installation locations always refers to the direction of travel.

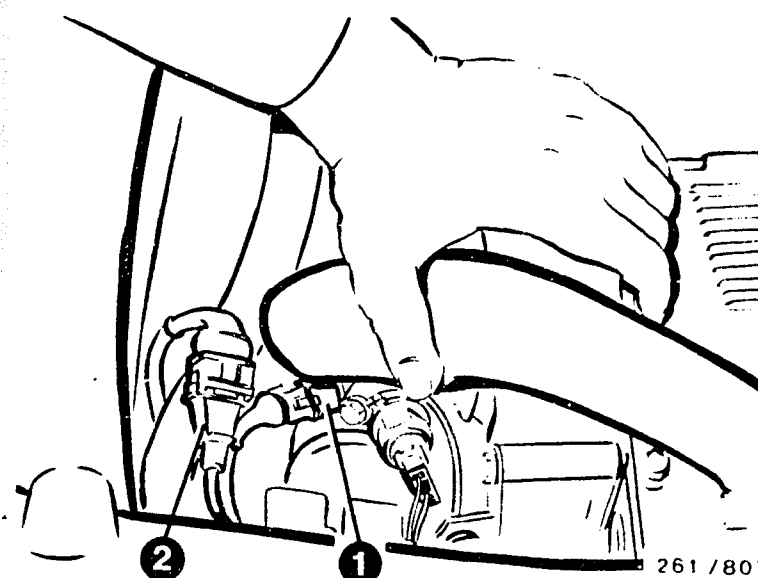
- * Control unit:
above ABS control unit (top picture, item 1)
- * Coding connection:
5-pole relay frame at wiring harness, in the vicinity of the control unit
(top picture, item 2).
- * Engine-speed/reference-mark sensor:
behind a plastic cover (center picture, arrow).
- * Temperature sensor (engine) and plug connection for engine-speed/reference-
mark sensor:
bottom picture, items 1 and 2.
- * Pressure damper:
ahead of pressure regulator.
- * Temperature sensor (intake air):
in air-flow sensor.



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INSTALLATION POSITION OF COMPONENTS (continued)

The installation locations always refer to the direction of travel.

* In-tank electric fuel pump:

In fuel tank (access by way of cover in trunk).
(Picture top left; Item 2 = Plug connection for fuel pump).

* Fuel filter:

Beneath vehicle (picture top right; Item 3).

* Fuse box:

Beneath instrument panel, left (center picture).

* Ignition mark (TDC):

Bottom picture, arrow.

* Lambda sensor:

Screwed into exhaust system upstream of catalytic converter
(not illustrated).

* Tank-ventilation switching valve and active-carbon container:

Beneath vehicle, ahead of left-hand front wheel house
(not illustrated).

